The Welding Engineer

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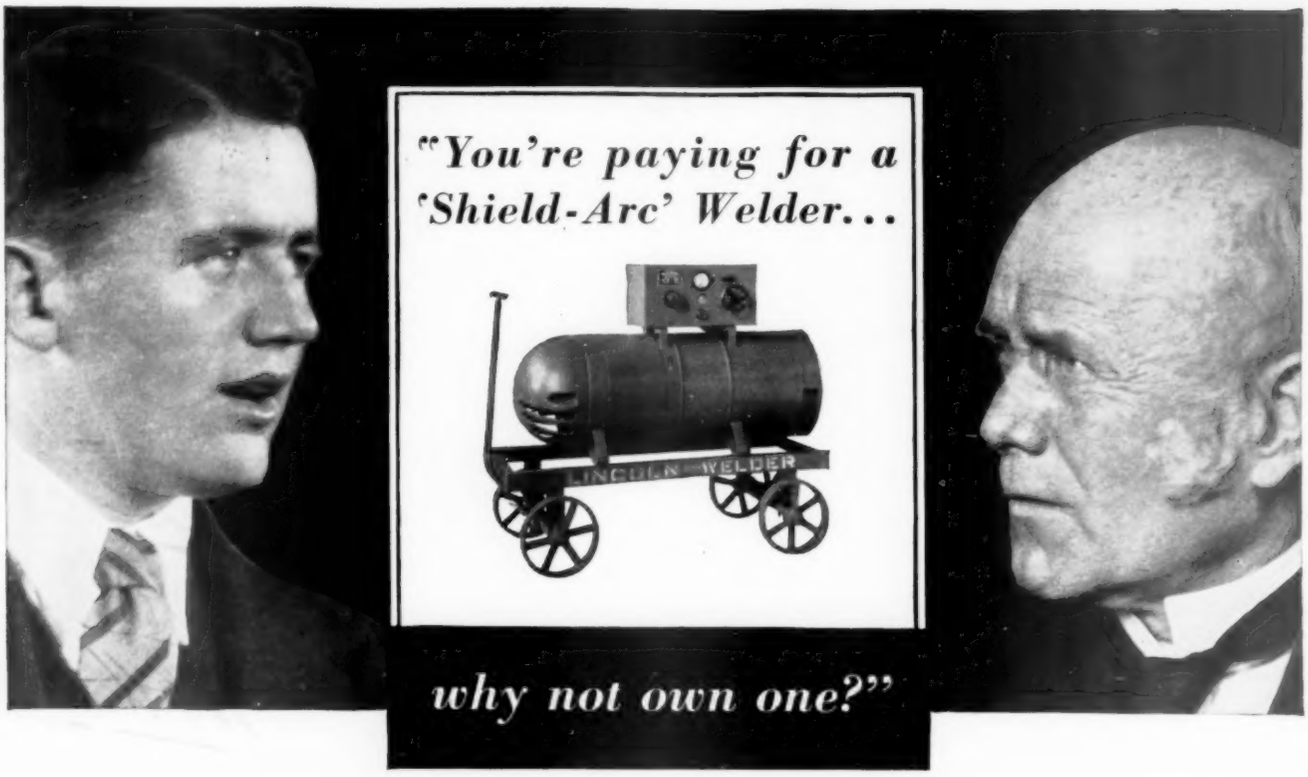
Robert and Steinman, Engineers — The "Sky Ride" With Welded Column Sections and Struts *(See Page 18)*

January
1933



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The Welding Engineer

Volume 18 January, 1933 Number 1

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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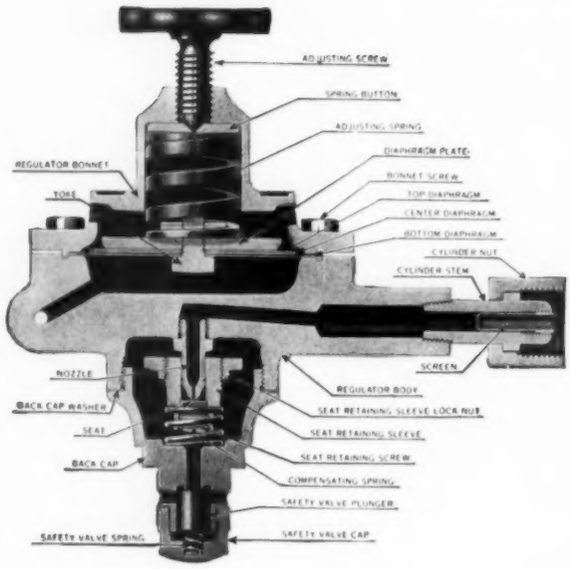

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[EDITORIAL]

The Case for the Machine

THE machine is the spoiled child of modern civilization—if we are to believe some pseudo-scientists who pretend at knowing what modern civilization is all about. It has become popular in many quarters to condemn the machine as being a breeder of unemployment just as some years back it was looked upon as being a robot which stripped men and women of their individuality.

* * *

IN analyzing problems having a social bearing, the tendency is to accept the validity of certain theories without subjecting them to such tests as will prove or disprove their soundness. As a result, we are imbued with many theories that will not stand such a test, and even men of high attainment and unquestionable open-mindedness do not agree among themselves as to the cause and results of many of our social problems.

* * *

REGARDING the charge that the machine creates unemployment, let us build up in our minds a hypothetical civilization of very limited size so we can easily understand all the details of the problems as we attempt to introduce into this civilization machines for the substitution of manual labor. Then we will see whether this thesis is true or false.

* * *

TO begin with, let us suppose that one such machine displaces ten workmen whose combined wages were $10,000 a year. After deducting say $3,000 a year—the overhead on the machine—it leaves an annual profit of $7,000 on the investment. This $7,000 must either appear as profits to the owners or must be used as a reserve in the business, or it must be swallowed up in the payment of increased wages to those participating in the business, or must be returned to the customers of the business in the form of lower prices for the finished product.

* * *

IRRESPECTIVE of which of these business policies is pursued, the fact remains that $7,000 per year in wealth has been created which heretofore did not exist, and this amount of wealth is sufficient to re-employ seven of the discharged men at their former wages. The re-employment of these men is apt to be an indirect process. For example, those to whom this wealth is going may use it to buy new automobiles, new radios, to hire chauffeurs or interior decorators. In any event, if the wealth is used, the results of increased employment is sufficient to counterbalance the discharge of seven of the ten men.

* * *

HOW about the other three unemployed of the original ten? We find that an annual charge of $3,000 is going for payment on this machinery and other overhead. If this money is to be used in the channels of trade, it means that $3,000 is available for employment. This, then, can result in absorbing the other three unemployed. The net result is that there was as much employment as before, and the products of such employment has been increased by the value of $7,000 per year. Thus the machine, if used to reduce costs of production, actually adds to the total wealth available for distribution.

* * *

AN analysis of this problem based on any other setup than that which we have assumed will still bring the same result, namely that the machine in itself does not create unemployment except during the brief period required for the distribution of new wealth to become felt and to take up the slack in employment. However, if the wealth created by the machine is not used but is hoarded, then this wealth cannot re-employ the labor displaced by the machine. But this is not the fault of the machine.

* * *

IT is also apparent that if too much capital goes into the building of capital goods (lathes, engines, adding machines, office buildings, etc.), not enough wealth is left over to buy the sugar, shoes, watches, etc. that the capital goods are producing. Then the industrial picture becomes out of balance, and the solution lies in the reduction in cost of consumer goods so more of them can be bought, without having to make a proportionate increase in the capital represented by capital goods.

* * *

THIS solution is arrived at by writing off a considerable amount of the capital invested in capital goods and stocks on hand. This is what is occurring in the writing down of inventory, in the contraction of capital stock, in the heavy write-offs in depreciation of plant, in reorganizations and receiverships, where fixed assets are being slashed to the bone. For the fact remains that the value of many of the capital goods purchased during 1927, '28 and '29 have heavily depreciated in the face of recent technical developments and reduced output.

* * *

ANOTHER solution lies in the substitution of economic machinery and processes for wasteful, expensive ones, even if such substitution results in a reduction in the labor payroll. Anything which will reduce costs of production will aid in bringing this industrial unbalance back into gear.

* * *

IN seeking a solution to this problem, it must be kept in mind that such solution must rest in the creation of wealth and in a sense of personal security and confidence that will result in this new wealth being used in the channels of trade and not "salted away" where it cannot be used as buying power or as a basis for credit.

* * *

WHERE it is evident that new machinery, new methods, and new processes will reduce costs, the use of such economical means will hasten the return of normal trade by creating additional wealth. Thus the machine, condemned as a transgressor of human rights, becomes the beacon light to lead us out of the darkness of economic despair to a new day.

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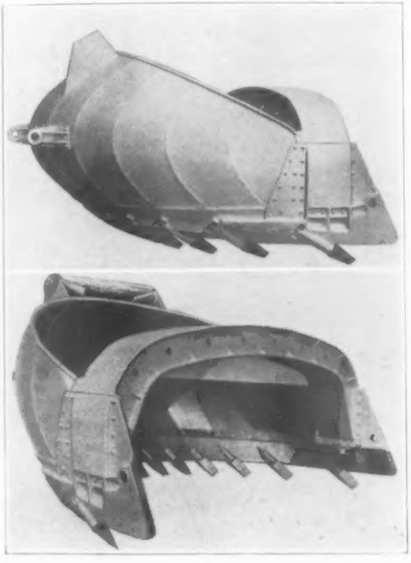
THE MONTHLY SYMPOSIUM

Production and Fabrication

Drag Scraper Bucket

The Crescent scraper shown in the illustrations is being used on Mississippi River levee-building tower machines. The curved plate design is made possible by the use of welded construction. The side walls of the bucket are made of relatively small segments of $\frac{5}{16}$-in. steel plate, rolled to



All-Welded Bucket of 12-Cu. Yd. Capacity.

shape and butt welded together. Two 1¼-in. half-round pieces of steel bars are welded to the top edge of the body plates to reinforce them. The body plates are riveted to the front bail and lower-lip casting.

The extensive use of welding in this new bucket made it possible practically to eliminate square and sharp corners on the inside to which mud and clay usually stick, and also to fabricate a new 12-cu. yd. bucket weighing less than the customary 10-cu. yd. Crescent bucket. This saving in weight made it possible to use the new bucket in places where the old smaller-capacity buckets were used.

The 12-cu. yd. Crescent scraper is 10 ft. 8 in. wide in the front, 10 ft. 6 in. long, stands approximately 6 ft. 6 in. high in the back and weighs 8700 lb. All the welding on the bucket was done by Lincoln Electric Company A. C. welders.

Hydraulic Jacks

By Elmo Judd
J. B. Lund's Sons, Cheboygan, Mich.

(Paper submitted for the Second Lincoln Arc Welding Prize Competition, sponsored by The Lincoln Electric Company, Cleveland, Ohio.)

Our shop has been employed recently in the manufacture of hydraulic jacks, the largest being of 45-tons capacity using 300 lb. pressure, double lift type, having one 10-in. and one 7-in. piston each 40 in. long. It is with the manufacture of these jacks that this paper is concerned.

We constructed a number of these jacks using steel castings for the pistons, but were troubled considerably with rough castings, it being necessary in almost every case to build them up to correct size by electric welding for machining and in some cases they had to be scrapped.

Seamless Tubing With Welded Heads Forms the Pistons for this Jack.

It can easily be understood that this was a very expensive method of manufacture, but not easily remedied by ordinary methods, since to make the castings large enough to insure enough stock for machining would be to make them too large for easy handling and also too expensive.

We finally decided to experiment with seamless steel tubing for these pistons and to electric weld the heads, etc., in place. If this method proved successful it would not be necessary to redesign the jacks, as the finished pistons would exactly duplicate the ones formerly used.

Production was immediately started on a set of four jacks, using steel tubing in place of castings for the pistons, and the finished product was a complete success. As the weld had to be made in the finished surface of the piston, it was imperative that it should machine perfectly, and as it was impossible to detect the weld in the finished piston, this gave us no trouble whatever.

It was rather difficult to compare the cost of the two methods of manufacture, since before the jacks were redesigned the machine and welding time varied

Portable Pre-Mix Plant is 85% Welded

The Iowa Manufacturing Company of Cedar Rapids, Iowa, manufacturers of the Cedar Rapids line of material handling equipment, recently announced the portable pre-mix plant shown in the illustration, which is an 85% arc welded job. The drier unit drum shown in the photograph is welded of 1-inch boiler plate. This drum is on its own truck and is fed by a belt conveyor. Welded construction has made possible exceptionally large capacity and high efficiency at a comparatively low construction cost.

Drying Drum Welded of One-Inch Boiler Plate.

widely in each unit, everything depending on the quality of the castings as received.

However, it was found that the welding time for electric welding the heads in place was 1¼ hours for each piston against an average time of 1½ hours for building up the castings in the old method, making a saving of 63c on each piston. The tubing, including the heads, cost $10.20 more than the castings for each size, but this was compensated for by a saving of 12 hours in machine time. At $1.50 per hour this made a saving of $7.80 for each piston ($18.00 less $10.20), plus 63c, or a total of $8.43 for each piston, or $16.86 for each jack. In addition to this the tubing was 100% usable and, being more uniform in texture, made the saving in tools and tool upkeep an appreciable item.

In this work we can credit our Lincoln electric welding machine with the saving of the castings under the first method, as without it we would have been unable to use 50% of the castings as received. Under the second method it was the means of making the use of tubing possible, as there was no other means of securing the heads in place without a complete redesign of the jacks. No trouble was experienced in leaky pistons as had been the case formerly.

Lincoln Stable-Arc rod was used in this work and produced a weld that was soft and easily machined as well as free

Maintenance Welding

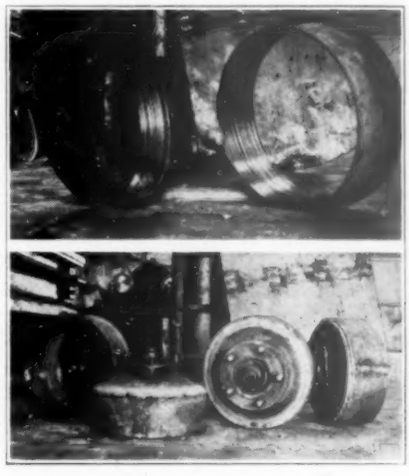
Brake Drums

By W. E. Archer

Through the development of quality electric welding, it has been made possible to fashion, or rebuild, a new type of brake drum ring for trucks subjected to heavy and strenuous use on the mountainous roads of California. Much heavy trucking of various commodities is done in transporting great quantities of freight overland to and from the Los Angeles and San Francisco markets. One of the main routes traversed by these trucks leads over the mountainous road known as "The Ridge Route," extending for some fifty miles through a range of mountains north of Los Angeles. On this road are many difficult grades and dangerous sharp turns which to negotiate with safety necessitates positive braking facilities. This road naturally puts brakes to severe tests, especially those of heavily loaded trucks.

Trucks equipped with the standard type of brake drums and rings rarely make more than a few trips over this route until the brake-drum rings are so badly scored and worn as to make installation of new ones imperative. One of the illustrations shows two of these badly scored rings just after removal from a truck which had made but one trip over the road above described. They were so badly worn that replacement was necessary before the return trip could be made.

The National Electric Welding Corporation, of Huntington Park, Calif., developed a method of taking these old drums and cutting the old rings off for replacement with new and heavier rings. The new rings are welded onto the old drums and guaranteed to last the life of the truck, regardless of the roads over which it is driven. Some of the newly rebuilt drums and rings are shown in one of the illustrations, which pictures



View of Worn Brake Drums (Top) and Welded Drums (Bottom).

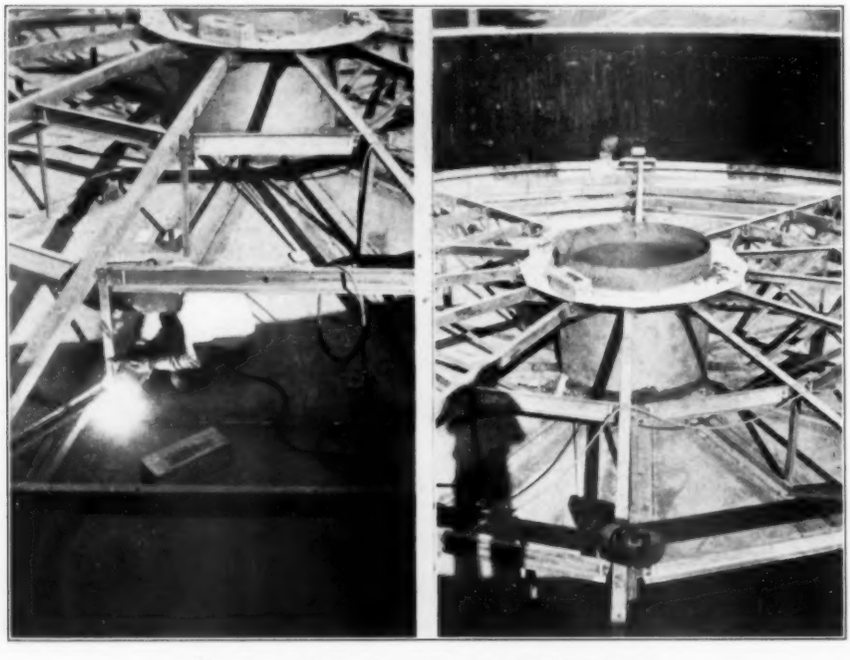
the heavy welding which is done in the rebuilding process. This welding is done by the electric arc.

The original rings of the drums with which the trucks come equipped, are about ¼ in. in thickness, while the material used by the replacing method herein described is 5/8 in. in thickness and of a better grade of steel plate which, it is stated, does not score.

The heavier steel plate, together with the high grade of electric welding, result in a more rigid drum and one capable of withstanding any strain to which it may be subjected.

The old drum is prepared for receiving the new ring by first being placed in a lathe and the old ring cut off by machine precision at exactly the proper point, leaving an even edge for welding on the new ring. In machining, a slight bevel is prepared to facilitate welding.

Most of these replacement rings, as before stated, are made of 5/8-in. steel plate, and usually are about 5 in. in width, the width depending of course upon the size and make of the truck to be equipped. The steel plate for the new rings is prepared first by cutting the proper length of strip for the ring, rolling to a circular shape, and then beveling the edges for welding. The ring is then welded on both sides. So accurate has this rolling operation been



Sewage Disposal Tank Has Welded Roof

The welding of a Downes floating roof in a sewage plant in Elgin, Ill., was recently completed by the W. F. Hallett Boiler Company, of which Howard Nutting is manager. A Una A-3 and a Una G-2 machine were used on the job, which required 250 lb. of ¼-in. Una No. 2000 rod. Two thousand lineal feet of lap welding was done on ¼-in. plate, 744 holes of about 1 in. diameter were filled, and 636 nuts and bolts were welded, all with a total of 80 man-hours. Five pin holes showed on testing.

developed that further shaping, or truing, of the ring in order properly to fit the drum is unnecessary. The ring is then placed in its proper position on the drum and welded solidly around the outside with heavy beads, using a 5/16-in. welding rod. No beveling is necessary in preparing the edge of the ring for welding to the drum. Roebling uncoated rods are used principally in this work. After welding, the drums are placed in a lathe for machining and truing up of the outer surface of the rings.

The National Electric Welding Corporation keeps a stock of these rings and drums on hand for several makes of standard trucks, all made up and ready for immediate installing. They point out that the average truck equipped with the ordinary standard brake drums will last at best not over six months, whereas, by replacing them with the heavier welded rings, they will positively last for the full lifetime of the truck.

The cost of replacing with welded rings is only a trifle over the cost of new drums, it is stated, so the saving is considerable, not to mention the added safety thus provided at all times.

Transmission Towers

By R. T. Quick

The welding process has proven to be the best practical means of reclaiming damaged steel electrical transmission towers which are set in concrete bases. One public utility company has found that partly due to improper protection, their steel tower legs have rusted and corroded just above the concrete bases causing failure. To repair these towers by means of riveting or bolting would not only weaken the structure because of the necessary drilling, but would be impractical as the legs are of triangular section. Welding provides a repair of greater strength than the original metal at a low cost.

In reclaiming damaged towers, the concrete is chipped away from around the broken legs and the twisted and corroded steel cut off. The tower is jacked up and set on the parts projecting from the base. These are butt welded to the legs, making use of a high test steel rod and without reenforcement of any kind. The steel is given a protective coating and concrete poured around the legs, providing a permanent repair.

With the Welderies

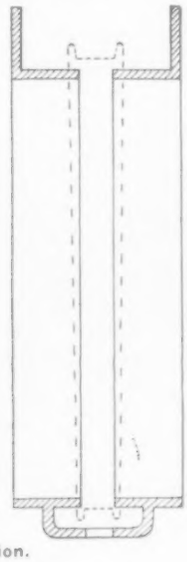
Five-Foot Gate Valves

By A. M. MacFarland

The 5-ft. gate valves shown in the accompanying illustration were made entirely from flat steel plate, formed, fabricated, welded and machined by the Youngstown Welding & Engineering Company, of Youngstown, Ohio. Intended for a blast-furnace gas line, the valves were required to be perfectly tight, without seepage, under a 10-in. head of water pressure.

The component parts were cut from steel plate by the acetylene torch. The contours were obtained with the aid of the shops' 250-ton hydraulic press. An approved, heavily coated welding wire was used, insuring tough, ductile welds throughout.

Referring to the cross-sectional diagram, the rings forming the valve seat were first rolled to hoop form, assembled and welded in position, with edges parallel spaced as shown. After all the other parts had been formed, assembled and welded, the seat was finished in a boring mill to fit the wedge-shaped gate. Finally the gate was ground to exactly fit the seat rings, by the novel process of alternately lifting and dropping the gate by means of an electric crane, the seat having previously been well smeared with grinding compound.



View of All-Welded Gate Valves, and Longitudinal Section.

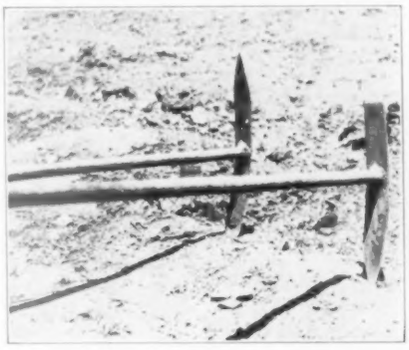
The job is an interesting example of forming, fitting and welding a large machined unit without distortion. The comparatively light construction and broad unstayed surfaces call for care and experienced handling in order to avoid trouble in maintaining the machined fits.

When finished, the valves presented all the advantages of cast construction, together with reduced weight and freedom from possible breakage—features inherent in the steel construction. A considerable saving in cost was also effected.

Garden Hoe

By R. G. Wilson

The hoes shown in the illustration are made from junk that accumulates in almost every garage. These were fabricated in the welder's spare time at Ellis' Garage & Machine Shop, in Griffin, Ga. Each hoe consists of a blade



Garden Tools Made From Spring Leaf and Pipe.

constructed from a broken automobile spring-leaf. A length of ½-in. pipe is welded to the piece of spring as shown. One end of the blade is cut to a point and serves as a pick in breaking into hard ground, and the other end is flattened and sharpened for a hoe.

Road Tamper

This hundred footed iron monster is a road tamper—one of four recently built by the City of Los Angeles Department of Water and Power without the use of a single bolt or rivet. The tamper weighs five tons. When the tank is filled with

Road Tamper of All-Welded Construction.

water the weight is increased to approximately seven tons. All parts of the machine were welded by the shielded-arc process, using equipment manufactured by The Lincoln Electric Company, Cleveland, Ohio. The total cost of fabrication was considerably less than is usually paid for tampers in the open market.

Two Towers, 628 Feet High, and 1850 Feet Apart, With Connecting Cables, Constitute the "Sky Ride" at Chicago's Century of Progress Exposition.

Welded Fabrication for the "Sky Ride"

By E. T. Blix
Chief Engineer, Mississippi Valley Structural Steel Company

THE dominating feature, both in size and interest, at A Century of Progress, Chicago's 1933 World's Fair, will be the "Sky Ride." This will consist of two towers reaching 628 ft. into the air, connected by cables suspended over the top of one tower and reaching to the top of the other 1,850 ft. away. This span exceeds the span of the Williamsburg Bridge in New York by 250 ft. One of the towers will be on the mainland north of the Hall of Science and the other will be on Northerly Island in Lake Michigan, north of the Electrical Group.

The cables will be anchored in a special counterbalanced anchorage 600 ft. behind the towers. These main cables support the track cables which encircle the towers at the 234-ft. level, carrying ten rocket cars with a capacity of thirty-two passengers each. At the center of each tower will be an elevator shaft, providing four elevators to the ride level platform at 234 ft., and two to the observation platform, containing 4,500 sq. ft., at the top.

The type of architecture used at A Century of Progress demanded that the strength of the material used in the towers be boldly shown and utilized to its fullest extent, eliminating the use of laced columns and curved members.

COLUMN sections and struts are shop welded and field riveted, 19 miles of automatic bead being required. Z-bar supports, floor plates, column-base details, door and window mullions and jambs, ladders, and hand railings are also welded

In the design of the corner columns for these towers a section consisting of three I-beams was determined upon. The least radius of gyration of this section is 50% greater than a single rolled section of the same area, permitting the panel points to be 25 ft. apart as against 16 ft. if a single section were used, which adds greatly to the appearance of the structure.

H-Column Welded From Three Beams

These beams are arranged and welded in the form of an H with a 15 in. beam acting as a web and two 20 in. beams as flanges, as shown in Fig. 1. The weight per foot of the 20 in. beams varies from a maximum of 150 lb. at the bottom of each column to 65.4 lb. at the top. Likewise, the 15 in. beams vary from 90 lb. at the bottom to 42.9 lb. at the top. The 20 in. beams were rolled with special rolls, and all beams were rolled with particular care so that they would have a minimum amount of variation. This was also true of the plates which form the web of the struts described hereafter. The plate widths are 12⅝ in., 13⅜ in., and so on. These were rolled so close that, with a few exceptions, the tolerance of plus $\frac{1}{16}$ in. and minus ⅛ in. for the distance back to back of channels of the struts was maintained.

In welding these columns, the three beams were first assembled in position and tack welded together. They were then placed in a cradle which could be rotated through 360°. The beams were then welded together along the toes of the 15-in. beam forming the web of the column. Before making each weld, the column was rotated so the surface of the weld would be horizontal during the welding operation. The welds were

laid 3 ft. in a continuous bead at each end and in 4½-in. spots every 12 in. The sections for the bottom of the columns were welded with ½-in. fillet welds, and ⅜-in. welds were employed for the top sections.

This welding was done with a Westinghouse automatic head mounted on a travel carriage designed and built by the Mississippi Valley Structural Steel Company. The carriage travels on the flanges of the beams. It is automatically controlled with two speeds, one

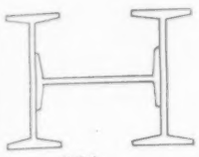


FIG. 1

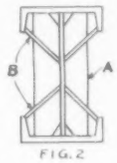


FIG. 2

Details of Column (Fig. 1) and Strut (Fig. 2).

for welding and a faster one for skipping, giving any desired spacing. Three-sixteenths-inch wire was used, and a speed of from 5 to 6 in. per minute obtained, depending on the size of the bead.

After making one weld between the edge of the 15-in. I-beam flange and the web of the 20-in. beam, the column is rotated in succession into three other positions, so that the final column has four seams of welding on each junction between the web of the 20-in. I-beam and the flange of the 15-in. beam.

After the three I-beams have been made into one column section, the assembled unit is then milled to the proper length. This milling disclosed the perfect welding which is done by the automatic machine.

After the milling operation, the columns are taken to a large drill which drills all necessary holes in the flanges and webs of the column section. Then the various gusset plates, clip angles and other angles are assembled to the columns and riveted by means of yoke riveters.

Struts and Diagonals

The base of the tower is a rectangle 50x110 ft. In order to obtain stiff, light members capable of joining these columns, a section consisting of two channels and a plate was determined upon for the struts and diagonals. These vary from a 15x⅛-in. plate with two 7-in. channels to 20x⅜-in. plates with two 15-in. channels.

Stiffener bars "A" (Fig. 2) were put in at the third points and the diagonal bar stiffeners "B" were put in at 4-ft. intervals. These reduce the unsupported length of the flanges, which it is not possible to do with a riveted section of four angles laced.

These struts are welded on a second automatic machine designed and built by the Mississippi Valley Structural Steel Company. It is equipped with two General Electric automatic welding heads and welds both sides of one edge of the plate to the channel at once. The strut is carried on a moving table through guide rolls and between the heads, the table traveling at 6 in. a minute while the heads are welding and at 40 ft. a minute while skipping to the next weld. The control of the heads and travel is completely automatic.

After the first channel is welded to the plate, the piece is placed in a jig so that the holes in one channel will line up with the holes in the other and the second channel tacked in place. It is then run through the automatic welder for the second operation. From here it goes to the detailing skids, where the bars "A" and "B" are added by hand welding. These struts are welded throughout with a ⅛-in. bead. There is 1 ft. of continuous weld at the ends and 3-in. spots every 9 in. on both sides.

A total of 96 column sections 50 ft. long and over five hundred struts will be used in the two towers. There will be approximately 19 miles of automatic bead on these two items alone which will consume about 3½ tons of welding wire.

Tests for Selecting Wire

Before starting on production, we welded experimental test pieces for about a week to obtain the desired quality of weld material. The factors entering in were, speed of travel, heat, and length of arc. On the strut welder any change in one head would affect the other. A change in the thickness of the material affects the other factors. The struts are run at 220 amp. at 6 in. a minute, giving a full ⅛-in. bead. The columns were welded at nearer 300 amp. at from 5 to 6 in. a minute, as the metal was much thicker, dissipating the heat faster.

Seven kinds of wire were experimented with and five kinds used for the final tests that were conducted at the Robert W. Hunt Company laboratories. From these data the wire was selected for the job.

Lateral Bracing

The lateral bracing at the top of each section of columns consists of a channel welded on one of the flanges to the inside of the web of another channel. (See Fig. 3.) These were run on the automatic.

The side walls of the elevator shaft are to be covered with interlocking 16-gage steel sheets, 2½ in. thick, filled

FIG. 3

FIG. 4

FIG. 5

FIG. 6

Details of Bracing, Supports and Floor.

with rock wool. To cover these at the top of each section and furnish a support for the next section, Z-bars were welded onto the backs of the 8-in. channels forming the struts for the elevator shaft. (See Fig. 4.) These were run

Twin Automatic Welding Machine Welding an I-Beam for the "Sky Ride"

Workman in Plant of Mississippi Valley Structural Steel Co. Welding Angles and Braces for the "Sky Ride"

through the automatic welder, both sides of the Z-bar being welded at once. These were welded 6 in. at the ends and 2-in. spots at 13½-in. centers. There were about 250 of these, each 30 ft. long. Across the short side of the elevator shaft 8-in. beams are used with the Z-bars set out from the web and connected to it by short pieces of Z 6 in. long welded vertically to the web. (See Fig. 5.) These were completely hand welded.

Battledeck-Type Floors

The biggest single item of hand welding was the floor plates at the ride level, and for the work floor at the top of tail, as well as for the enclosed observatory at the top of the towers, and the open-air observatory at the top. The floors have battledeck construction. The floor plates are 60 in. by about 20 ft. and are welded to channels at both edges with an I-beam welded to them in the middle. (See Fig. 6.) Small bars with holes are welded to the bottom of the channels and beams, furnishing a connection to the supporting members. The clear span in all cases is 10 ft. or less.

These sections are assembled bottom side up on the welding skids. Wherever possible, several sections are assembled together to avoid any accumulative error in the plates when assembled in the towers.

In addition to the main columns, there are also the back leg columns, which start 50 ft. back from the main columns and run up to the ride level. They form a brace for the tower and also a support for the platforms where the cars are stored and repaired. Both the main columns and the back leg columns have a welded and riveted base detail.

Column Base Plates

The column base plates are welded onto the shaft and the plates at the tops of the base details are welded to the channel stiffeners and to the gusset plates at the base of the columns. This provides a less cumbersome and at the same time a stronger detail than would have been possible with rivets alone.

To support the pins of the counterbalanced cable anchorage mentioned in the first of this article, welded bolsters are used in place of a casting. These are built up out of 2-in. plates, and the pin holes are bored after the whole piece is welded. They take a reaction of 253,000 lb.

A stairway leads up to the 200-ft. level, and ladders from there to the top. These ladders are made of upset rungs and punched bars, the rungs being welded to the bars through the holes. At intervals are safety platforms upon which one can stop and rest. These small platforms are welded, as are various door and window mullions and jambs throughout the tower.

The fills throughout the job are tack welded to the pieces they go on instead of being bolted for shipment. This adds considerably to the ease of erection as well and avoids loss of small parts between the shop and job.

At the house at the ride level and at the enclosed observatory, the modernistic hand railings are welded out of 2½x½-in. flat bars bent with 1¼-in. square posts running through them.

Track Welded to Angle Supports

As the cars come in they run around a track consisting of round-nosed 5x 1⅛-in. bars bent to a radius. These bars are held upright by means of 3x3-in. angle clips welded to each side.

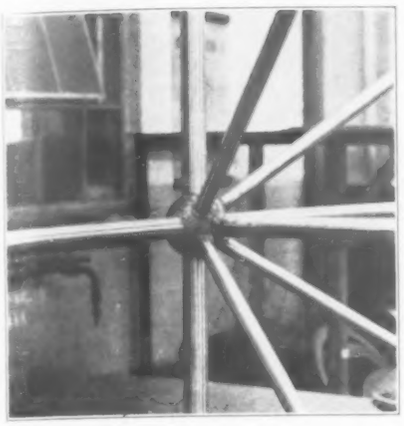
The windows at the observation platform at the top are set at a double bevel. The top of the bottom sash and the bottom of the top sash are set out so that whether one looks up or down, the line of vision is about 90° with the windows. The mullions between these windows will be 5-in. I-beams, notched and bent and welded together. The detail for connecting them also will be welded.

All the field connections will be riveted or bolted. No attempt was made to make this either a riveted or a welded job, either means of fabrication being used where it was found to be most suitable.

These towers are being financed by a group of contractors who are thereby holding their organization together and furnishing work to a large group of men who otherwise would not have employment. The foundations are furnished by the Great Lakes Dredge and Dock Company, and the steel by the Inland Steel Company. The fabrication and erection of steel is by the Mississippi Valley Structural Steel Company, the erection being sublet to the Overland Construction Company. The elevators are furnished by the Otis Elevator Company, and the cables and rocket cars by John A. Roebling's Sons Company, the cars being sublet to the Zeppelin Corporation of Akron, Ohio. The Century of Progress furnishes the sheeting, flooring and lighting and miscellaneous items. The towers were designed by Robinson and Steinman of New York, with R. Boblow as resident engineer. Joshua D'Esposito is chief engineer of the project, with I. F. Stern acting as consultant.

Compressed Gas Manufacturers Hold Annual Meeting

On January 23rd and 24th will be held the twentieth annual meeting of the Compressed Gas Manufacturers Association, at The Waldorf-Astoria, Park Ave. at 50th St., New York City. The meeting will close with the annual dinner at 7:00 p. m. on January 24th in the Sert Room of The Waldorf-Astoria. The meeting is to be of a less technical nature than usual. The papers will be largely devoted to the dependence of other industries upon industrial gases, stressing the utilization of compressed gases. Each of the major compressed-gas industries has a part in the program. The National Bottled Gas Association is holding its meeting simultaneously, and several of the program sessions will be jointly sponsored.



Tubular Structural Joint With Spherical Joint Piece

ABSTRACT from a paper by Aubrey F. Burstall, Engineer in Charge of Welding, and Harold Kenney and Reginald A. Smith, Assistant Engineers, Welding Department, Imperial Chemical Industries, Ltd., Billingham, Stockton-on-Tees, England. This paper was awarded a $100 prize in the Second Lincoln Arc Welding Prize Competition, sponsored by The Lincoln Electric Company, Cleveland, Ohio. A total of $17,500 was awarded in this competition. The sponsors plan on publishing the leading papers submitted in the prize contest in book form at a later date.

Using Tubes as Structural Members—I

First of a Series of Three Articles

As riveting and bolting have been used for such a long time as methods for connecting together the parts of steel structures, the layman is usually inclined to think of welded structures in terms of the same standard structural shapes. This attitude is forced upon the engineer and designer by the economic fact that so much capital has been invested in machines for producing steel in these shapes that the cost of standard structural shapes has been reduced to a very low figure.

A student of welding, however, is unable to accept these sections as his raw material for building steel structures without first examining them from a scientific point of view to see if they really are the most suitable for this form of construction. One of the simplest ways of doing this is, first to consider what were the requirements of the older form of construction and to what extent these have been met by the sections that have been evolved, and then to consider what are the requirements of welding and to visualize the shape of member that meets them most fully from the designer's point of view.

Influence of Riveted Design

It is fairly obvious that when structures are built by joining members together with bolts or rivets, holes must be drilled at various parts of the sections and, for convenience, it is obviously preferable that the sections should be so shaped that these holes can be drilled at any point along their lengths, so that the sections can be manufactured in long lengths and cut up to suit the requirements of each structure. Moreover, since bolting and riveting were the principal methods of attachment of members to one another, it followed that wherever the designer desired to make other attachments to the structure—for example, in the middle of a member—the same method of joining would normally be employed. It was, therefore, necessary that he should be able to drill holes at any place along the length of his members.

A further necessary property of the present structural sections, which is frequently forgotten owing to our great familiarity with them, is that they must possess flat surfaces all along their lengths for convenience in riveting and bolting. The riveted and bolted joints are, of course, essentially lap joints and it is necessary that the two members being joined together should overlap one another at a joint, or each to be overlapped by a new member common to both—for example, a gusset plate. For this type of connection to be possible at any point along the length of a member, it is obviously most convenient that it should possess flat surfaces for such connections. It is also frequently impossible to use "closed" sections, such as a square or circle, owing to the difficulty of entering the bolt or rivet. We may, therefore, add that for this method of joining it is usually imperative that the sections should have all along their lengths flat surfaces that are easy of access on all sides.

Flat Surfaces Unnecessary

If we consider the design from the point of view of the new welding process, we see that it does not demand any of the requirements specified in the previous paragraphs; in fact, we may consider our sections purely from the design point of view and not from the practical considerations which were the main limitations with the former type of construction.

Every engineer who served his apprenticeship before the advent of welding will remember his annoyance when he drilled a hole too large or took too

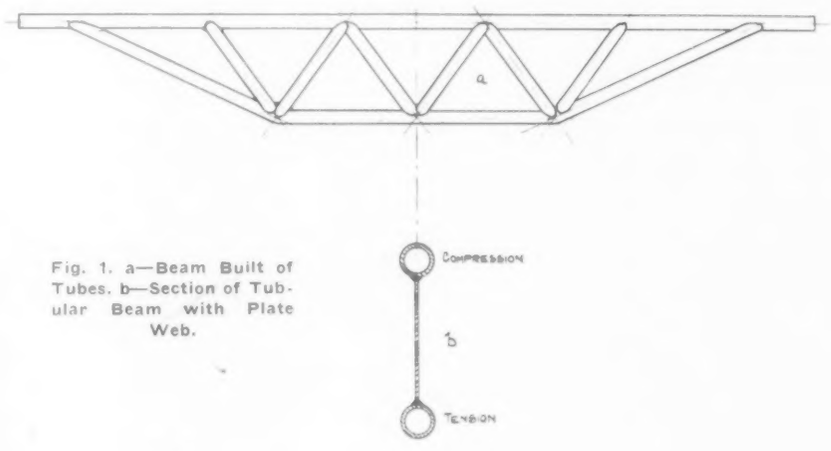


Fig. 1. a—Beam Built of Tubes. b—Section of Tubular Beam with Plate Web.

big a cut on the lathe so that the article on which he was working had to be replaced. It was a common saying in the workshop that there was no "putting on" tool in those cases, and the young apprentice was advised always to bear this in mind. Since the advent of welding this state of affairs has been altered, and we now have a "putting on" tool which alters the whole complexion of engineering design and operation. It is the most remarkable property of the new process when considered in relation to the design and fabrication of structures. For instance, when we wish to make an attachment to a structure, we need not drill a hole at that point to fasten a bracket, but we can weld it; and, therefore, as we have seen already, we can employ the whole cross-sectional area of our members to carry the load. Again, we do not need to overlap our members at connecting points by other members or by jointing pieces, as we can butt two members together and weld. Hence it is not essential that members of welded structures should present flat surfaces all along their lengths, and so they can be curved, if curved surfaces present any other advantage.

Large Section Modulus in All Directions

In considering what type of section is most suitable from a scientific point of view for the manufacture of structures, the student will at once remember that tubes are unique among all sections in that they provide the greatest section modulus in all directions of any section for a given weight of material. They are thus the ideal sections for columns where this property is the paramount essential, and they are suitable as tension members on account of their equal resistance to lateral movement in all directions.

As beams, we have to admit, the I-section provides a greater resistance to bending for the same weight of material than a tube of similar dimensions and weight, though we can design a tube to have the same moment of resistance to bending if we increase the dimensions sufficiently. Alternatively, we can design composite beams from a series of tubes joined together by flats or a lattice work of smaller tubes, or we can deform our tube into an egg-shaped section or to a contour similar to the I-section. Some suggested forms of tubular beams are shown in Figure 1.

The advantages of the tube as a structural member have long been recognized by design engineers but tubes have not been generally utilized hitherto on account of the limitations of the jointing processes employed. In certain cases, however, they have been used, as, for instance, when very large sections are employed, such as on the Forth Bridge in Scotland, where built-up riveted tubular members were employed, and on airplanes and airships, where the maximum strength is required for a given weight of material. This latter point is, of course, the whole crux of the matter when one selects the most suitable sections for design purposes apart from any consideration of the method of jointing. Logically, one should employ that shape of section which provides the maximum strength for the minimum weight of material.

Uniform Stress Distribution

The majority of the calculations that the structural designer is called upon to perform are concerned with tension and compression members in which the stresses set up by the loads imposed upon the members are greatly affected by the eccentricity of loading and eccentricities introduced by imperfection of manufacture. In the case of tension members this factor is usually allowed

Fig. 2. Use of Tubes for Diagonal Bracing.

for when the center of gravity of the member is definitely out of line with the center of gravity of the load by an appreciable amount—for example, when an angle tie is fastened at its ends by only one of the legs of the angle—by neglecting 20% of the net section of the angle, because the local stresses set up in the angle by this method of attachment far exceed the average direct stress over the cross-section. Further evidence that the local stresses set up at a joint may exceed the average stress is obtained in the case of a wide, flat tie bar. The lines of stress converge towards the edges of the tie bar at the point of attachment, and close to the center of the tie bar there is no stress at all. From these observations it would appear that a tie bar of circular section, whether solid or hollow, butt-welded at its ends is the only simple means by which uniform stress distribution at the ends of the tie bar can be attained.

It follows, therefore, that in such a case—that is, where care has been taken to ensure uniform stress distribution in the tension bar—there is ample justification for decreasing the factor of safety employed, as this is governed by the maximum stresses set up and not by the average stress in any member of a structure.

Turning now to the more frequently met case of compression members or columns, the effect of eccentricity of loading is even more pronounced, because in a long tie bar the stress imposed by eccentricity at the ends tends to even out in the middle of the tie bar as the load is applied—that is, in the center of a tie bar infinitely long the stresses would be uniform across the section even though the ends might be eccentrically loaded. Not so in the case of columns, however, for in this case the slightest eccentricity of load makes a large difference in the maximum load which the column will withstand. Moreover, the eccentricity introduced by imperfections of manufacture, initial curvature, etc., are usually ignored in empirical design formulas or masked by the adoption of large factors of safety in such irrational formulas.

It is generally recognized that the eccentricity of loading should be minimized in the design itself by employing sections whose center of gravity lies along the line of thrust—for example, two channel sections back to back or a box section is frequently used, and since welding has been available the star section has come much into favor. The difficulty then is to ensure that the load is applied at the center of the section, and welding has done much to reduce this difficulty.

Another factor of vital importance to the designer of columns is the amount of rigidity or fixity of the ends of the column. The aim is always to fix the ends as rigidly as possible, thus increasing the permissible load on the column, but experiments have shown that the degree of fixity that can be obtained by either of the older forms of joint (bolting and riveting) is small, and that for practical purposes it is advisable to assume that the columns behave as if they were pin pointed members.

Effect on Factor of Safety

These considerations have a great effect upon the decision as to what factor of safety should be adopted for any particular type of construction. It is significant that where tubes are used as structural members and where the stresses have to be very accurately calculated—for example, in airplane and airship structures—it is normal to employ a factor of safety of nearly unity—that is, all possible allowances of loading and imperfection are made as mentioned, and then a maximum total stress equal to the yield point of the material in compression is permitted.

In considering the merits of tubes as structural members compared with the usual shaped connections, any savings in weight that can be made produce savings in foundation costs, in the case of tall buildings, and savings in transport of the steel right from its manufacture up to its final placing in position on the finished structure. These

transport savings are particularly important in large territories and in undeveloped countries to which the steelwork has to be exported by sea. Again, in desert countries, sometimes the steelwork for a building has to be conveyed by mule or camel over long distances, and in these cases the value of savings in weight will be very readily appreciated. For these reasons tubes have already been used in some cases for erecting buildings in the far east.

Small Surface Exposed to Corrosion

Another factor which has to be considered in deciding upon the dimensions of structural members is the superficial surface in terms of the strength and the thickness of the metal at any point on account of corrosion.

We are all aware that the solid circular section provides the minimum surface for corrosion for a given weight of material of uniform section and that this section would require the minimum amount of paint per unit weight of material and, therefore, that the minimum corrosion would occur per unit weight of material.

We are, however, considering our structural members from the point of view of their strength, and the solid circle or round bar does not possess sufficient rigidity per unit of weight for our purposes and hence we have adopted the tubular type. Therefore, we increase superficial surface very considerably as compared with the solid round bar, but it must be mentioned that in using tubular sections as structural members, one would obviously seal their ends at all points by arc welding so that no internal corrosion could occur. If we compare a tube with a flat bar of the same thickness, it is manifest that the amount of paint required and the surface exposed to corrosion with the tube are both approximately half that of the flat bar. Thus, if the thickness of metal of the tubes is the same as that of the usual structural members—flats, angles, tees, etc. —it is reasonable to adopt a smaller minimum thickness to allow for corrosion of approximately one-half. Alternatively, one may adopt a smaller factor of safety when the thickness is the same.

Pleasing to the Eye

It cannot be denied that the symmetry of a circular shape appeals to the eye and gives to a structure a pleasing appearance which is not possessed by structures composed of members of less symmetrical section. Those who have seen the tubular structure of an all-metal airplane under-carriage will appreciate this point, which can hardly be conveyed adequately by photographs. Those who have not seen it are asked to imagine what a bicycle frame would look like if it were composed of the usual structural members, channels, angles and so on, as compared with tubes. In addition, tubular structures have a smoothness and accessibility not possessed by other sections—for example, a heavy bicycle frame can be grasped anywhere along the tubular sections and lifted without hurting the hands. Other tubular structures possess an accessibility which is difficult to attain with the usual sections—for example, the diamond bracing of a structure with flats or angles to take tension by any deforming forces can be replaced by the use of a single tube to operate in either tension or compression, and thus the structure becomes more accessible. An example of a tubular bracing of this type in a welded structure made otherwise of channels and the usual sections is shown in Figure 2.

Painting and Cleaning Less Costly

The smoothness of tubular structures has the additional advantage that painting, and the cleaning which necessarily precedes it, are both simplified by the absence of sharp corners and projections.

It is hardly necessary to state that if structural members of a single shape can be used for all purposes, it is much easier to standardize them than flats, angles, channels, tees, H-sections, and other shapes now used in structural work. With tubular sections as members for structural work, it is possible to standardize upon a single shape, and, though the variations in diameter and thickness required to accommodate all the purposes of the structural engineer are fairly considerable, they are by no means so many as the vast series of sections at present used for structural work. It is, therefore, a far easier matter to standardize the tubular section than the present sections in use, and when this is done a table of physical properties for tubes similar to those now used for structural work will have to be drawn up for all the standard sections. Meanwhile the constants for any particular dimension of tube must be calculated unless they can be found in the handbook of some tube or pipe manufacturer.

Smaller Inventory

It is perhaps not out of place to mention at this point that one of the essential features of tubes, and indeed of any other section for structural work, is that they should be produced of uniform section throughout their lengths, as well as concentric and straight. The tolerances of straightness and eccentricity of bore and thickness must, therefore, all be specified when tubes are purchased for structural work. [The effect of variations in these three tolerances are dealth with in the appendix to the paper, where the column formulas have been extended and simplified to include these items.]

It should, therefore be clear that if tubes are standardized for structural work, fewer stocks will have to be kept by manufacturers and constructors and hence a saving in capital will be effected.

(To be continued)

Rail-End Welding to Be Considered at Chicago Meeting

How the welder removes the panketypank-pank from railroad travel will be told in a paper on "Rail-End Welding" by A. W. McClary, of the Hollup Corporation, at a meeting of the Chicago Section, American Welding Society, to be held Friday, January 20th, at 7:30 p. m. in the Palmer House. The speaker will deal specifically with steam railroad practice and will touch upon electric welding and the grinding equipment used. Motion pictures will illustrate the procedure and will also show the repairing of manganese crossings.

The Final Report of the Committee on Welded Rail Joints, which was recently issued by the American Welding Society and associated organizations, will be reviewed by J. Wolfe, assistant superintendent, track and roadway, Chicago Surface Lines, who is a member of the committee. A general discussion will follow. The meeting will be preceded by the usual get-to-gether dinner at 6:00 p. m.

Iowa State College Holds Its Fifth Welding Conference

The fifth welding conference at Iowa State College, Ames, Iowa, is being held January 18th to 20th, with a full program of papers, demonstrations, and qualification tests. The complete program of papers is as follows:

Weld Testing and Qualification of Welders, by F. C. Hutchinson, Linde Air Products Co.

Metal Spraying, by Chas. Stipp, The Metallizing Co. of America.

Review of Gas Welding and Cutting, by H. R. Salisbury, Air Reduction Sales Co.

The Welding Shop Proprietor's Point of View.

Gas and Arc Welding of Copper Alloys, by H. G. Wallis, American Brass Co.

Review of Electric Welding, by G. F. Clipsham, Lincoln Electric Co.

Recent Developments in Hard Facing, by F. P. Shephard, Haynes Stellite Co.

Electrodes, by F. S. Peasley, General Electric Co.

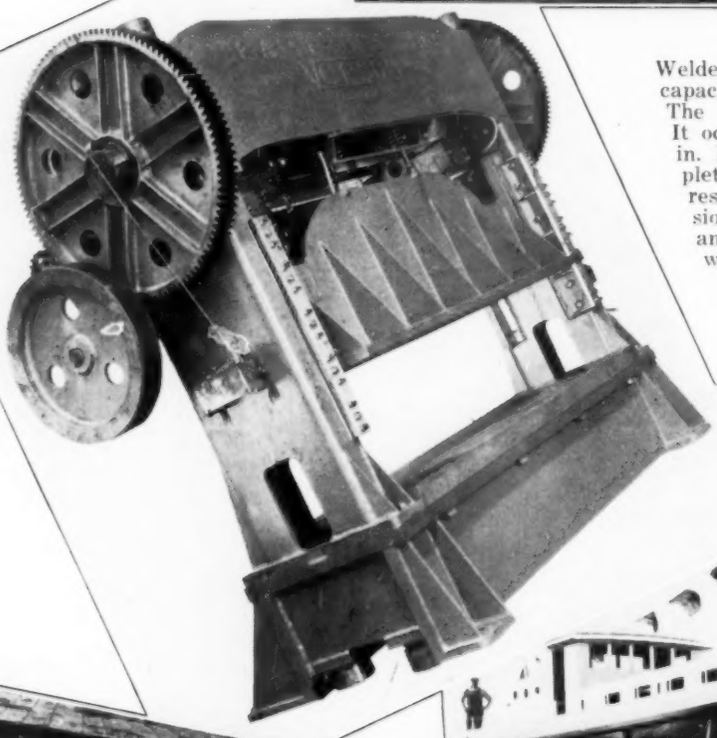
Welders Round Table, in charge of Wm. Mobley, Omaha Welding Co.

The New Story of the Red Ball, motion pictures on manufacture and use of wrought iron, by the A. M. Byers Co.

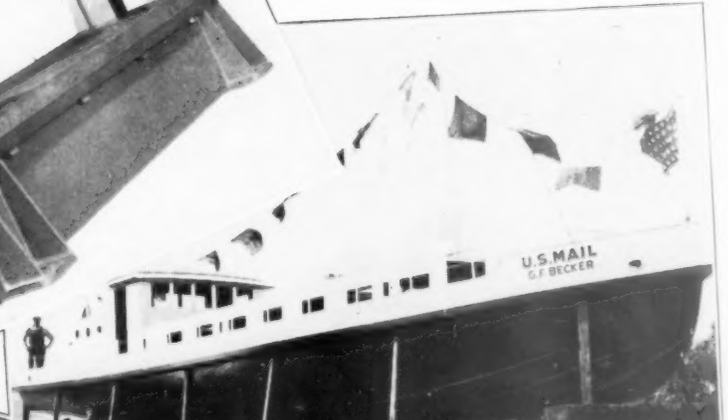
The papers program is scheduled only during the morning of each of the three days, and the afternoons are devoted to demonstrations and qualification tests. Everyone is invited to make welds, which will be tested during these afternoon periods. The program of the conference has been prepared under the direction of D. C. Faber, director, Engineering Extension Service, of the college, and the interest which is being created in the conference presages a large attendance from Iowa and adjoining states.

WELDING NEWS IN PICTURES - - -

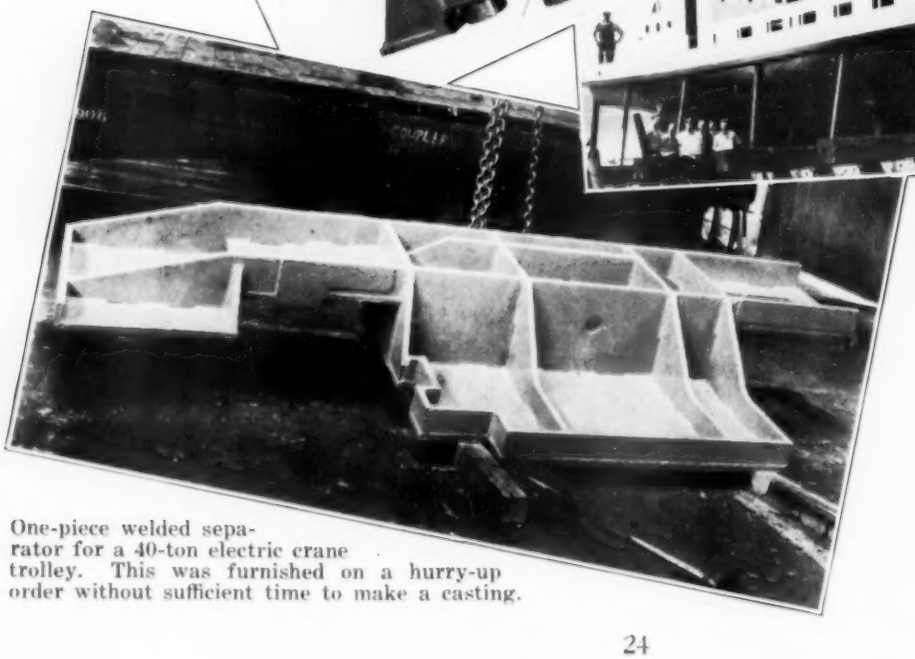
Battery of electric welding machines on duty at the plant of the Standard Oil Company of Kansas, Neodesha, Kan. These units, together with three acetylene welding outfits, are part of the equipment used in the installation of a stabilizing unit and a large-capacity cracking still.



Welded all-steel Verson press of 350-ton capacity, designed and constructed by The Allsteel Press Company, Chicago. It occupies 82x190 in. floor area, is 154 in. high, and weighs 100,000 lb. complete. The welded steel construction results in less weight, reduced dimensions, saving in power consumption, and lower foundation costs compared with a cast-iron design.



This, the world's only floating postoffice, is an all-welded boat and has been in service 24 hr. a day since last July 1st. It was built by the Hans Hansen Welding Company, Toledo. The hull is 64 ft. 9 in. long, formed of ¼-in. and ⅜-in. Armco plate. The sheets were lapped and continuous arc welded both outside and inside. The beam is 16 ft.



One-piece welded separator for a 40-ton electric crane trolley. This was furnished on a hurry-up order without sufficient time to make a casting.

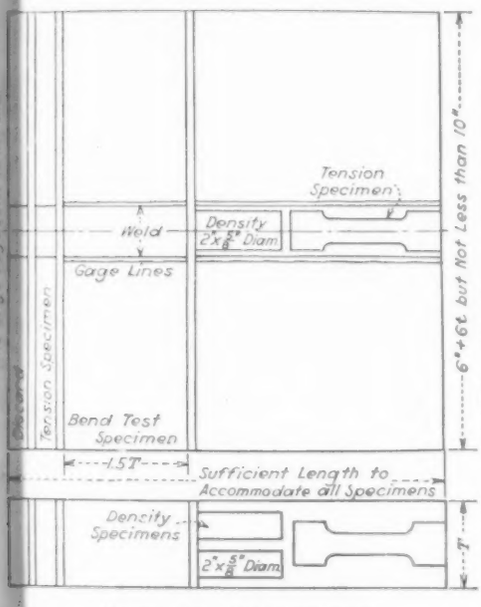
Modern Weld Testing

The significance of procedure control in connection with interpretation of results

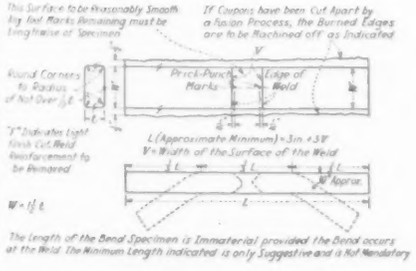
By J. B. Green
President, Fusion Welding Corporation

A POTENT factor in standardizing weld testing is Section VIII of the A. S. M. E. Boiler Construction Code entitled, "Rules for Construction of Unfired Pressure Vessels". Naturally, this code has also been a factor in standardizing the skill of the operator, the quality of the welding rod and, in fact, everything which directly or indirectly affects weld quality. In this code, the various physical tests are quite fully described and minimum values set. The illustrations accompanying this article indicate the character of test specimens called for in the code and the captions are either directly quoted from the code or summarize various portions of it.

So far as the code is concerned, it is left to the operator as to how the weld metal for the test specimens shall be developed. It must be remembered that the code is not a welding manual but a statement of the quality required in unfired pressure vessels. In other words, the code specifies results and is not concerned directly with how they are obtained. In due time, a procedure code will probably appear, but first experience must be acquired and reported, then verified and established. Fabricators are naturally loathe to make public the details of procedures which have cost them large sums of money to develop. Information of this kind gets into print slowly and a bit at a time. The present article attempts to report some phases of procedure as they affect modern weld testing.

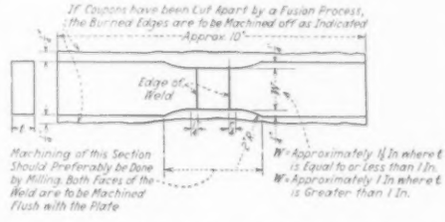


Layout for Weld Specimens.


This Surface to be Reasonably Smooth
If Coupons have been Cut Apart by a Fusion Process, the Burned Edges are to be Machined off as Indicated
Round Corners to Radius of Not Over 1/2 t
Prick-Punch Marks
Edge of Weld
"t" Indicates Light Finish Cut. Weld Reinforcement to be Removed
L (Approximate Minimum) = 3 in. + 5T
W = Width of the Surface of the Weld
W = 1 1/2 t
The Length of the Bend Specimen is Immaterial provided the Bend occurs at the Weld. The Minimum Length Indicated is only Suggestive and is Not Mandatory

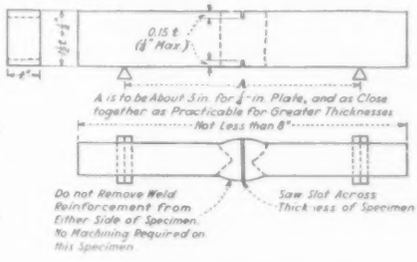
Free-Bend Test Specimen.

(The specimen shall be bent cold under free bending conditions and the least elongation measured within or across approximately the entire weld on the outside fibers. When a crack is observed in the convex surface of the specimen between the edges, the specimen shall be considered to have failed. Cracks at the corners of the specimen shall not be considered as a failure nor the appearance of small defects in the convex surface if the greatest dimension does not exceed 1/16 in. Minimum requirements are: Class 1, 30%; Class 2, 20%; and Class 3, 10%.)


If Coupons have been Cut Apart by a Fusion Process, the Burned Edges are to be Machined off as Indicated
Approx. 10"
Edge of Weld
Machining of this Section Should Preferably be Done by Milling. Both Faces of the Weld are to be Machined Flush with the Plate
W = Approximately 1 1/2 in. where t is Equal to or Less than 1 1/2 in.
W = Approximately 1 1/2 in. where t is Greater than 1 1/2 in.

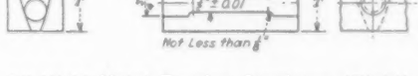
Reduced-Section Joint Tensile Specimen.

(The ultimate tensile strength shall be not less than the minimum of the specified tensile range of the plate used for Class 1, 95% of this value for Class 2, and 85% for Class 3, but in no case less than 42,000 lb. per sq. in.)


0.15 t (1" Max.)
A is to be About 3 in. for 1/2-in. Plate, and as Close together as Practicable for Greater Thicknesses
Not Less than 8"
Do not Remove Weld Reinforcement from Either Side of Specimen. No Machining Required on this Specimen
Saw Slot Across Thickness of Specimen

Specimen for Nick-Break Test.

(The nick-break test for soundness of the weld shall show in the fractured surface complete penetration through the entire thickness of the weld, absence of oxide or slag inclusions, and a degree of porosity not to exceed six gas pockets per square inch of the total area of the weld surface exposed in the fracture, the maximum dimension of any such pocket not to be in excess of 1/16 in.)



All-Weld-Metal Tension Specimen (Right).

(Tensile strength shall at least equal that of the minimum of the range of the plate which is welded and the minimum elongation shall be 20% in two inches.)

Density Specimens (Left).

(These specimens shall, if possible, be 2 in. long by 5/8 in. in diameter and shall show a minimum specific gravity of 7.80 grams per cubic centimeter determined by measuring and weighing.)

Physical Properties of Weld Metal

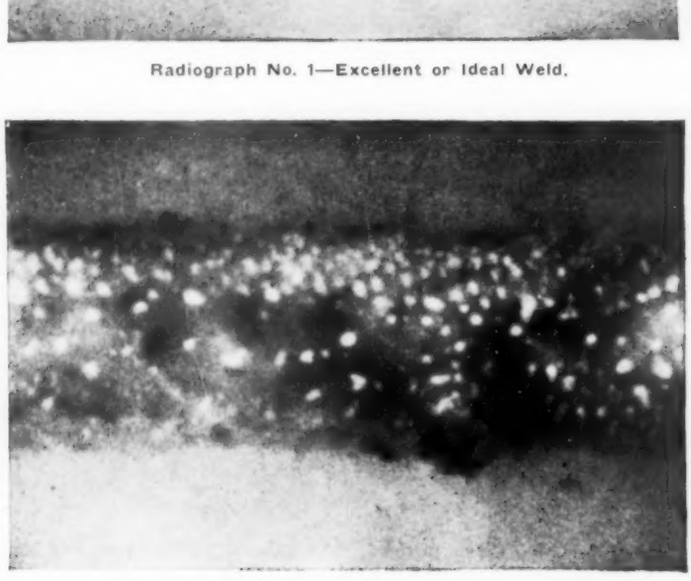
Every mild-steel weld possesses certain inherent physical properties derived from its chemical composition. The weld metal is essentially iron alloyed or mixed with carbon, manganese, sulphur, phosphorus and silicon, and it often contains copper, nitrogen, oxygen, slag inclusions, gas holes and possibly one or more alloying elements residual in the welding rod or deliberately introduced into the rod or through the flux coating. Whatever the physical properties of the weld may be due to its chemical composition, they may be altered by annealing and working. Both annealing and working are matters of procedure, and the chemistry of the weld is usually affected within certain limits by the procedure employed. Otherwise the chemistry is a matter of the rod, flux and parent metal.

Both welding rods and operators are now rated according to the A. S. M. E. Code tests. A rod or operator is said to have passed or not to have passed. The procedure employed must be known before the results of these modern tests really become valuable. Suppose a set of tests passed the minimum requirements as specified in the code but some trick procedure, uneconomical or impracticable in commercial work, was employed. Then a welding rod or operator might be approved, but nothing gained of commercial value. On the other hand, a good rod or operator might fail to pass merely because of faulty procedure.

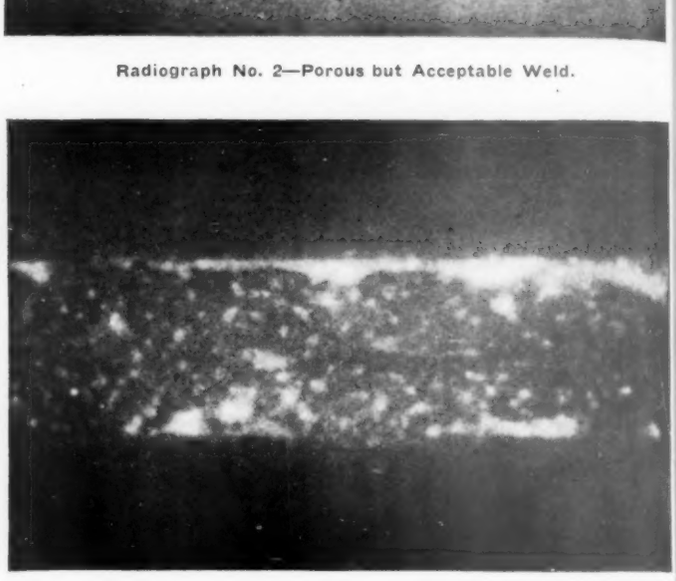
In discussing the effect of procedure, a shielded-arc mild-steel metallic-arc electrode will be taken as a basis for illustration. In developing a procedure, the first consideration is a deposit as

Radiograph No. 1—Excellent or Ideal Weld.

Radiograph No. 2—Porous but Acceptable Weld.



Radiograph No. 3—Porous and Unacceptable Weld.



Radiograph No. 4—Defective Weld Along Wall of Joint (Not Acceptable).

free from gas and slag inclusions as possible. The current, arc length, movement of the arc end of the electrode, and direction of magnetic blow of the arc are the controlling factors. The X-ray, if available, is the best quick test, and, if not available, the nick-break test should be used where allowed. Unless a combination of the factors controlling the gas and slag inclusions can be found which results in a deposit passing the A. S. M. E. X-ray or nick-break requirements, it can be assumed that the electrode or parent metal is faulty, and further testing can properly be abandoned. This much can be called the procedure for density or soundness.

Effect of Annealing and Working

Next comes the procedure which has to do with annealing and working. It is assumed that certain fluxes in contact with molten and possibly cooling metal tend to coarsen the metallic crystals, while other fluxes tend to fine them. Whatever the tendency on this score, it can be accentuated through procedure control. Applying successive layers of weld metal, at such short intervals that each preceding layer is still quite hot, tends to anneal the deposit, reducing its tensile strength and increasing its ductility. For example, a butt weld in, say, a 1-in. plate made so that each layer is allowed to cool to room temperature before applying the next layer may show an ultimate tensile strength of about 72,000 lb. per sq. in. and an elongation of 18%. Cutting the time allowed for cooling in two will lower the tensile strength by 2,000 to 3,000 lb. per sq. in. and increase the elongation to about 28%. As 20% is the minimum elongation for Class 1 pressure vessels under the A. S. M. E. code, the procedure can entirely decide whether the weld is rejected or is passed. Peening with an air hammer is part of the procedure. This can be done with a blunt-nose tool, which tends to work the metal but involves the risk of driving slag into the deposit; or a chisel-edge tool may be used, which very nicely removes the slag but does not work the metal.

In preparing specimens for testing, that procedure should be adopted which, if applied to commercial welds, will prove economical and practicable and still give the highest test values.

Who Should Develop Procedure?

The electrode manufacturer is quite generally looked to by the user for a statement of the proper procedure to employ in the case of all electrodes offered for sale. As a matter of fact, this is not the best source to go to for such information. Electrode manufacturers are rarely users of electrodes on an extensive scale, and only a user can properly develop a procedure. Close cooperation between producer and consumer is essential, but the user should take the initiative. Large users thoroughly appreciate this and more often than not develop their own procedure, keeping it strictly secret.

Expensive Development Work

The cost of such development work runs quite high. One to two days' time is required of an expert welder and helper to prepare a set of A. S. M. E. code specimens for one position in heavy plate. For three positions, a working week can easily be consumed. It takes a machinist about twice as long to finish the specimens as it does the welder to prepare them, and the testing laboratory about half as long to do the testing and computation work. Thus the time totals about as follows: Welding operator, 6 days; helper, 6 days; machinist, 12 days; testing engineer, 3 days. In addition, there is considerable material used.

Now suppose it is desired to find the best diameter of electrode, value of current, arc voltage, and cooling rate for each different thickness of plate.

To do this, suppose the experiments include the following:

2 Diameters of electrode for each plate thickness
3 Values of current
2 Values of arc voltage
2 Values of cooling rate
4 Plate thicknesses

This means that the tests referred to above must be repeated 96 times; and as it takes something over 200 man-hours per test, the cost will be extremely high and the user must cut corners wherever possible. It will not do to attempt to throw this cost back on the electrode manufacturer. It is just as prohibitive to him as to the user and he is not nearly so well qualified to do the work. In a subsequent article a suggestion will be offered as to how to handle the matter economically.

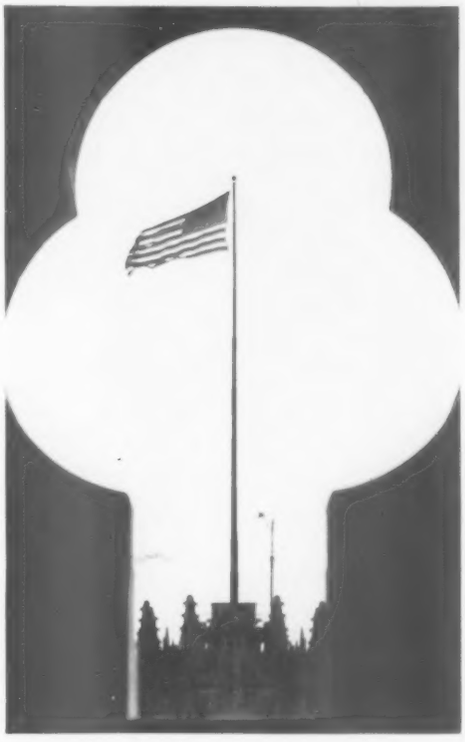
Welded 90-ft. Flag Pole

DEDICATION ceremonies at the top of the Tribune Tower, Chicago, recently marked the completion of a new 90-ft. arc-welded steel flag pole which now tops this famous building. The flag pole consists of telescoped pipe sections fabricated in position on top of the Tower at a height ranging from 456 ft. at the base of the pole to 546 ft. at the top. This job is believed to have set a new altitude record for arc-welding operations. A view of the steel erection tower and the partially erected flag pole as photographed from the top of the Wrigley Building is shown in one of the illustrations.

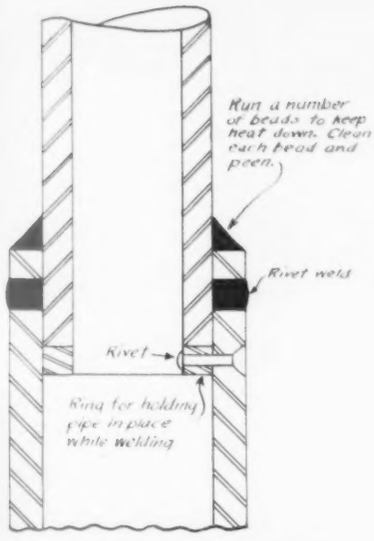
Eight different sizes of pipe were used in the construction of the flag pole, the base section having an inside diameter of 18 in., with a wall thickness of ½-in., and the top section having an inside diameter of 5 in., with a wall thickness of ⅜-in.

The telescope construction of various pipe sections formed a total of eight sleeve joints. The diagram shows a detail of a typical joint. In order to hold the sections in place prior to welding, each section had a ring secured to its inner wall at a distance below the top of its upper end. This distance varied from 42 in. for the base section to 19 in. for the section next to the top. Each section of pipe as placed in position rested upon this ring in the lower section of pipe. The adjacent pipe sections were fillet welded to each other by welding the top edge of the lower section to the outer wall of the upper section around the entire circumference of the pipe. A view of a typical fillet weld partially completed at the fourth joint from the base is shown in one of the illustrations. Eight plug welds 1 in. in diameter were made at equally spaced distances around the entire circumference of the pipe at each joint near the lower end of the upper section. Thus at each joint the sections of pipe were fused into each other at two separate circumferential locations.

The flag pole is subjected to terrific strain due to wind pressure. It was therefore essential that the metal of the welds have physical characteristics at least equal to those of the pipe metal. To procure such welds the shielded-arc process of welding was employed by the welding contractor, The Western Welding & Boiler Repair Company, of Chicago. Welding equipment manufactured by The Lincoln Electric Company, Cleveland, Ohio, was used by this contractor for all welding. The welded construction of the flag pole was carefully inspected during the actual process of welding by the municipal building authorities of the city of Chicago and approved by them upon completion.



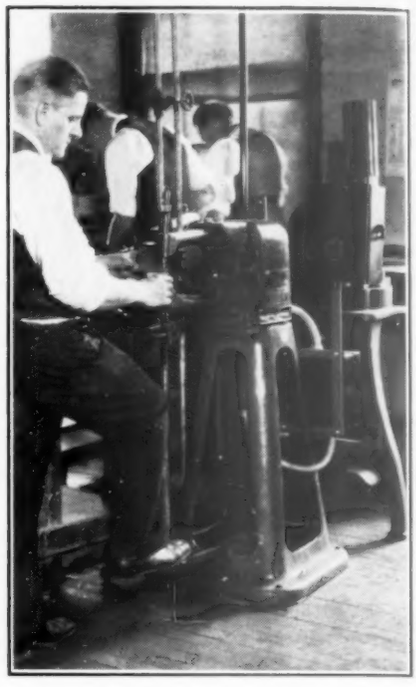
View of Completed Flag Pole.


Run a number of beads to keep heat down. Clean each bead and peen.
Rivet welds
Rivet
Ring for holding pipe in place while welding

Sectional Diagram Showing Design of Joint.

(Left) Partly Completed Pole and Scaffolding as Seen From the Wrigley Building. (Right) Inspector and Welder at one of the Joints.

Vacuum-Tube Control *applied to* Spot Welding Equipment



The tube timer, properly adjusted, insures that the current is "on" just long enough to make a good weld without burning the material.

By E. U. Lassen
Supervising Engineer, Cutler-Hammer, Inc.

AUTOMATIC timing control is a valuable adjunct to many applications of spot-welding machines. If after the work has been clamped between the electrodes, current is applied to the weld for too short a time, the heat will not be sufficient to cause proper fusion and union of the pieces. If, on the other hand, the current is "on" too long, the metal at the weld is burned, and this mars the appearance of the work and often reduces the strength of the weld. To insure the proper meeting, automatic timing is necessary.

Compact automatic control equipment, known as tube timers, can be used to perform the necessary function of automatic timing control in conjunction with a main power magnetic switch or contactor. The application of such control is not limited to new machines, but can be made on existing installations as well. Thus there are a large number of foot-operated machines in service at the present time which have no provision for automatic timing and to which a tube timer is readily applicable. This type of timer is especially applicable to air or hydraulically operated machines, and also to motor-driven machines where consistent accuracy of timing and convenience of time adjustment are important.

Pushbutton or Pressure-Switch Control

Such control may be operated through a pushbutton station or other type of hand-operated pilot switch, or through a pressure-responsive pilot switch which insures that the electrodes properly clamp the material before the welding current is permitted to flow and the timing period begins. When the pilot device is operated, the tube control functions and causes closure of the main contactor for the exact period of time for which the timing control is set, which, in the apparatus shown in Fig. 1 may be anywhere from 1/10 to 18 seconds.

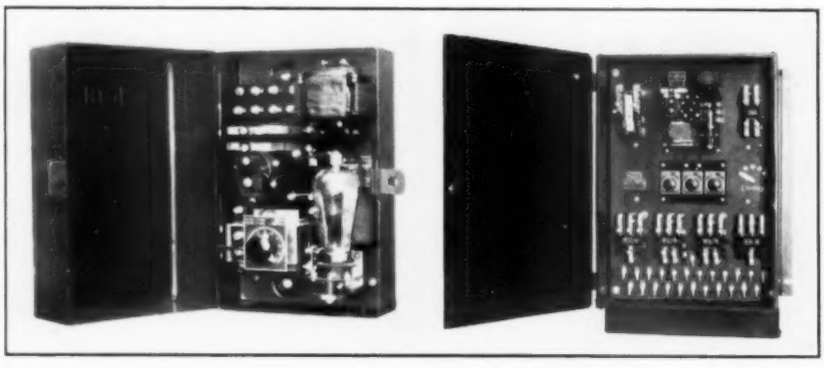


Fig. 1. Cover of Timer Open Showing Thyratron Tube, Rheostat, and Other Parts.

Fig. 2. The Three Rheostats Allow Adjustment for Three Independent Welding Periods.

A tube timer such as that shown contains a Thyratron tube controlling a relay, equipped with normally closed contacts, which, in turn, control the welding contactor. The charge on a fixed condenser controls the tube. Normally the tube conducts current, and thus the control relay is energized so that its normally closed contacts are open and the welding contactor therefore is open. However, if the pilot device is actuated to start a welding operation, the condenser charge immediately blocks the tube so that it can not conduct, and the relay consequently drops out, closing a set of contacts and causing the welding contactor to close and thus starting the welding period. The condenser has a definite electrical charge at the beginning of each welding period, and it causes the welding period to continue until its charge has dropped a definite amount, when it permits the tube to conduct again.

The controller is provided with an adjustable rheostat which determines the length of time required for the condenser to discharge, and thus the time for the welding operation is regulated. On the standard unit this small rheostat is mounted inside the enclosing case of the timer, so that only an authorized person can change the timing period.

High Degree of Accuracy

In order to illustrate the accuracy of timing by this method, Table 1 gives the test data of seven stock timers. In addition to the accuracy with which each individual timer repeats its time period, the table also gives a comparison of time intervals of different commercial units for the same position of their rheostats. The figures in the

table give the welding periods measured by the number of cycles of an alternating current power supply.

Table 2 records the test of two timers which was made to determine the influence of variation in line voltage on the timing accuracy. The timers were nominally 440-volt equipments, and the time is shown in seconds plus cycles for the normal voltage, as well as for voltages of 15% below and 10% above normal. Timer No. 1 was set for a maximum time of nominally 7 seconds, while timer No. 2 was set for 16 seconds. For the last two settings of the second timer, comparative readings were made on the same voltage and rheostat settings to show the degree of accuracy on repeated operation.

The tube timer used in these tests is that shown in Fig. 1. It is rugged and simple in construction, and its characteristics are definite, and once adjusted they remain constant. Adjustment of time is very easily accomplished, and the range of adjustment between maximum and minimum time is very great. The accuracy is well within requirements. The entire mechanism is mounted in a small, neat wall-type enclosing case.

Three Controllers in One

A special timer control based on the same principle as the apparatus already described is shown in Figure 2. In the center of the control panel are three small adjustable rheostats which can be set for three independent welding periods to suit three different welding requirements. A three-button control station is used, and the operator selects the proper period for the weld by pressing the corresponding button.

Table 1. Test on FG-65 Thyratrons in Welding Timer.

Rheostat Setting	Tube Designation C-H	2A	3A	4A	5A	6A	7A
	Number of cycles						
0	6	6	6	7	7	6	7
	6	6	6	6	7	6	7
	5	7	6	6	6	6	7
	6	6	6	7	7	7	6
5	88	88	87	88	94	98	93
	87	91	87	88	94	98	92
	89	92	89	90	93	97	93
	84	92	88	88	94	98	94
100	169	181	178	178	181	179	180
	168	178	178	180	179	182	179
	168	178	179	178	180	178	180
	168	183	177	182	182	183	181

Table 2. Timing Tests with Tube Timer.

	Rheostat Setting	Seconds + Cycles at Line Voltage 375 V.	440 V.	484 V.
Timer No. 1	0		0+ 3	
	2	0+ 8	0+ 8	0+ 7
	4		0+17	
	6		0+28	
	6.5	0+38	0+38	0+37
	7.0		0+43	
	7.5	1+18	1+10	1+ 8
	8.0		2+56	
	8.5	5+18	4+46	4+42
	9.0		6+50	
	9.2	7+15	7+10	7+ 7
Timer No. 2	0	0+ 7	0+ 6	0+ 6
	2		0+25	
	4		0+50	
	6	5+ 2	4+58	4+58
	7		9+50	
	8	12+48	12+38	12+37
	8	12+44	12+24	12+32
	8	12+37	12+30	12+38
	8	12+39	12+33	12+43
	9.3		15+57	
	9.3		15+52	
	9.3		16+18	
	9.3		15+58	

This controller also provides an interlock with the hydraulic pressure exerted upon the electrodes, and also special interlocks with two other welders and their controllers.

One feature of these controllers is the provision that the electrode pressure is maintained automatically for 0.5 second after the welding current is cut off, to permit the heavy weld to solidify before the pressure is removed.

The Problem of Line Contactors

When, in the operation of the timer, the welding period is only a fraction of a second, special attention must be given to the design of the main contactor, since this contactor must operate almost instantly upon closing of the control relay. This necessarily requires low inertia of the moving parts

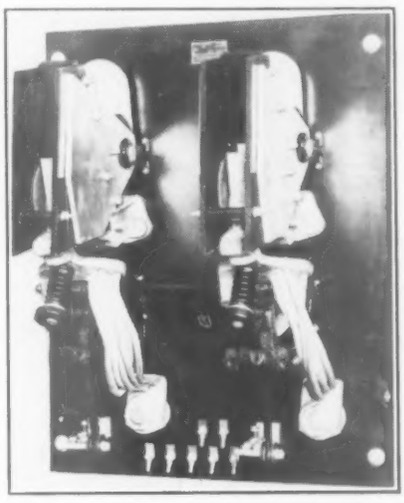


Fig. 3. Alternating-Current Switches Designed for Operation by Rectified Current.

and circuits which respond readily to the controlling mechanism.

Contactors operated by direct-current magnets generally have the advantage of permitting more frequent operation than alternating-current contactors, due to the high initial current required by the latter. In some cases direct-current magnets are therefore preferred. Fig. 3 shows the contactor for handling a spot-welding circuit which is actuated by rectified current. The 600-ampere direct current contactor of this type may be operated as frequently as 100 to 150 times a minute, as compared with approximately 25 operations of an alternating-current contactor of conventional design and of the same capacity. By substituting a direct-current contactor for an alternating-current contactor, its life, according to tests, is increased from 5,000,000 operations to 8,000,000.

Effect of Fluctuations in Line Voltage

The operation of the tube timer is affected by wide voltage fluctuations. On large welding machines, it is advisable therefore that the tube timer be operated from a lighting circuit which is independent of the power circuit to which the welder is connected. If, however, direct-current contactors are used, similar to the one just described, it is often possible to operate the timer from the same power circuit as the welder, since this contactor does not draw the heavy inrush currents that an alternating-current contactor requires.

Meeting of Indiana Ironsmiths and Welders

The 1933 annual state convention of The Indiana Ironsmiths and Welders Association will be held at Purdue University, Lafayette, Ind., April 11th and 12th. Plans are in the making to have exhibits and demonstrations of welding equipment and other lines that pertain to the field covered by the association. Further information can be obtained from Wm. J. Volpert, Secretary, 25 West 3rd St., Peru, Ind.

Los Angeles Section Hears Paper on Railway Welding

"Economies Effected by Welding in the Railway Industry" is the subject of a talk by Frank Longo to be given before the Los Angeles Section, American Welding Society, on January 19th. At this meeting the retiring chairman, Turner Smith, will also present his annual report, which will deal with proposals relating to local developments in welding, regulative codes, specifications, exchange of information, and ethics. The annual business meeting and election of officers will also take place.

Welding Day at Highway Congress in Detroit

January 18th was observed as Welding Day, under the joint sponsorship of the Highway Congress and the American Welding Society in Detroit. A paper by Col. A. S. Douglass, construction engineer, Detroit Edison Company, described some of the many practical applications that his company has found for the welding art. Another paper, entitled "Welding in Action," was given by Joseph Matte, Jr., construction engineer, Albert Kahn, Inc.

New York Engineering Groups Hold Joint Welding Program

The New York Section of the American Welding Society and the Iron and Steel Division and Machine Shop Practice Division of the American Society of Mechanical Engineers held a joint meeting in the Engineering Societies Building on January 10th at which two papers were presented on the subject of the application of welded design and construction to heavy equipment. The authors were A. E. Gibson, vice-president, Wellman Engineering Company, and H. G. Marsh, Carnegie Steel Company.

All-Welded Cotton Seed Storage Tanks

Details of design and construction of ventilated tanks for storing cotton seed, as erected and welded in the field by the J. B. Klein Iron & Foundry Company

By M. L. Rogers

THE erection of large storage tanks for cotton seed has opened up a new field for welding which bids fair to become very active. Two such tanks have been completed by the J. B. Klein Iron Works, of Oklahoma City, Okla., for the Chickasha Cotton Seed Oil Company. These tanks are 80 ft. in diameter and 79 ft. 2 in. extreme height, all welded, with the exception of a concrete base.

Several cotton seed storage tanks of smaller dimensions than these have been in use for a number of years. They were not fabricated by welding, but were riveted, and some were constructed of concrete. This is an interesting fact because it shows beyond a doubt that this is a new field opening up and not an experiment. An advantage of these tanks is that they will store cotton seed for an indefinite period with no loss of weight or strength, also, the proper amount of moisture can be retained, or, if desired, the seed can be dried out. This is done through ventilators which are installed in a tunnel running through the center underneath the floor. To increase the moisture, the vents are opened during damp weather only; if the seed has been dried, the vents are opened only during extremely dry atmospheric conditions. This type of storage tank also has the advantages of low insurance rates, compact storage, neatness, and durability.

150 Tons of Steel per Tank

In the construction of the welded tanks, approximately 150 tons of steel was used; to hoist this into place a guide derrick was installed, of the boom type. A gin pole would not be practicable for a job of this height. None of the welders hired were subjected to tests, but they were men of reputation in tank welding. The welding was of a nature that required a welder to be quite skilled in putting on the proper weld, as the sheets were not prepared for welding. A butt weld was used with practically no spacing or none; therefore a great deal of heat was necessary to burn through, which is very difficult when making a vertical or horizontal weld on plates of the thickness used. All seams were welded inside and out with the exception of the two top rings and seams, which were covered by a channel-iron band, and also the roof.

In fabricating, first the 12-in. channel was laid into place on top of the concrete foundation, lugs were then welded on, as described in Figure 1, then bolted into place and leveled; then the ends of channels were welded together to make a solid ring. After this was completed, the first ring of the shell was ready to put into place.

Channels Formed to Proper Radius

All channel iron was rolled in the plant to the proper radius before shipping, but all flat material was shipped just as it had come from the mills—in other words, the shell and the roof were not rolled to radius but had to be sprung into place. The roof laid so nearly flat that the effect was hardly noticeable, also it was of light gage (10 gage).

The sheets for the shell of the tank were 18x6 ft. The first two rings were ⅜-in. ply; third to seventh rings $\frac{5}{16}$-in. ply; and eighth, ninth, and tenth rings ¼-in. ply. All sheets were checked for length and squared before erecting. If necessary to trim, an acetylene torch was used, and all holes were cut by torch.

The sheets for the first ring were checked for length, squared, and sprung to radius, and then hoisted into place. The first sheet is set inside the 12-in. channel, 4 in. from the bottom, and then tack welded at as many places as the sheet sets up to the channel. Then the second sheet is set into place, and also tack welded. Sheet after sheet is set in place in this manner, until the ring is completed. Then by means of a U-plate and wedge the sheet is drawn up into place, and after the tacking is completed the ring is welded inside and out. All rings are erected in the same manner, with the exception that the first ring sets inside the bottom channel, and each of the remaining rings sets on top of and is butt welded to the ring underneath.

Reinforcing Rings

Bands or rings of 9-in. channel iron of 13.4-lb. material were used for reinforcement to guard against wind stress and inside impact loads. These bands were spaced 15 ft. apart, as shown in Figure 2, and were welded solid on top, using about a ⅜-in. full bead, and on the bottom of the channel a 3-in. tack weld was placed about every 18 in. For scaffolds, brackets

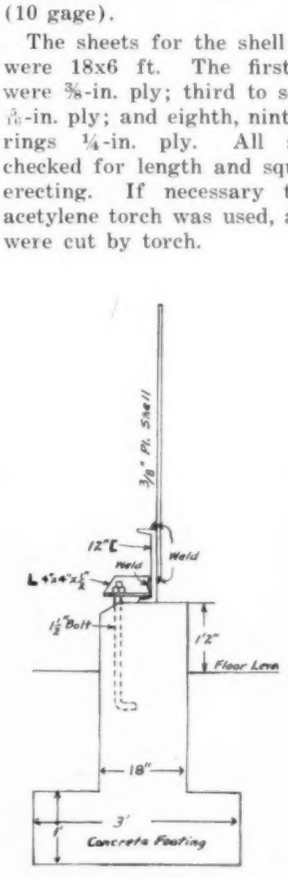


Fig. 1. Method of Anchoring Sheet to Foundation.

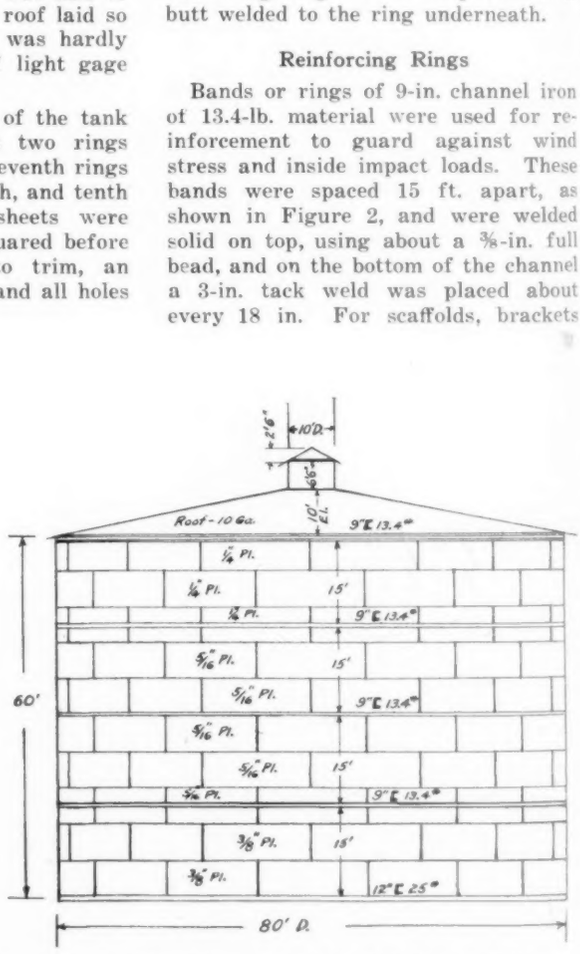
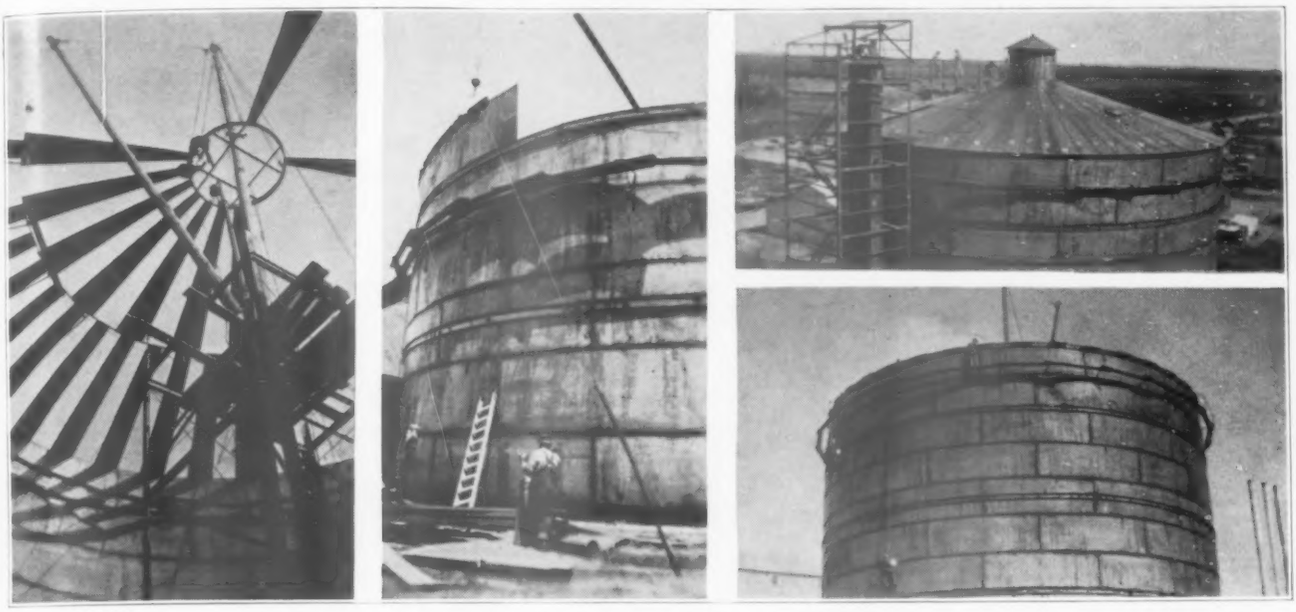


Fig. 2. Dimensions of Tank and Design of Shell and Reinforcing Channel-Iron Rings.



Views of Tank Taken During Progress of Its Erection.

were bolted to the shell at 10-ft. intervals, using ½-in. bolts, then 2x12-in. planks were laid to walk on. Holes in the shell were plugged from a sling attached to a block and tackle.

Roof Supports

The roof supports were constructed as shown in Figure 3. These supports were fabricated in the plant and sent out ready to erect. The roof plates or sheets were tacked in place on the ground before erecting.

Figure 4 shows how the roof supports were placed, also how the sheets were laid. The roof sheeting, being only 10-gage metal, was very easily pressed into place with the foot while tack welding. The roof supports were bolted into place, then made secure with heavy tack welds. The cupola, which sets on top, was erected on the ground and set into place and then welded.

For welding vertical seams, we used approximately 50 volts and 150 amperes; for horizontal, 60 volts and 175 to 200 amperes. There was approximately 14,000 ft. of welding besides the tacking and plugging holes.

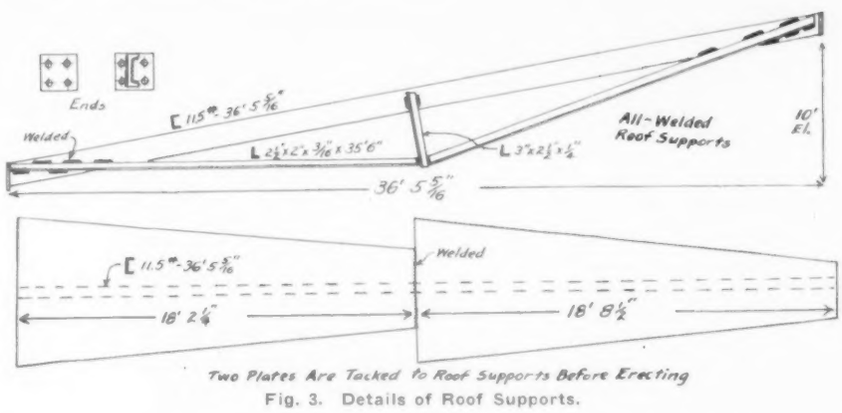


Fig. 3. Details of Roof Supports.

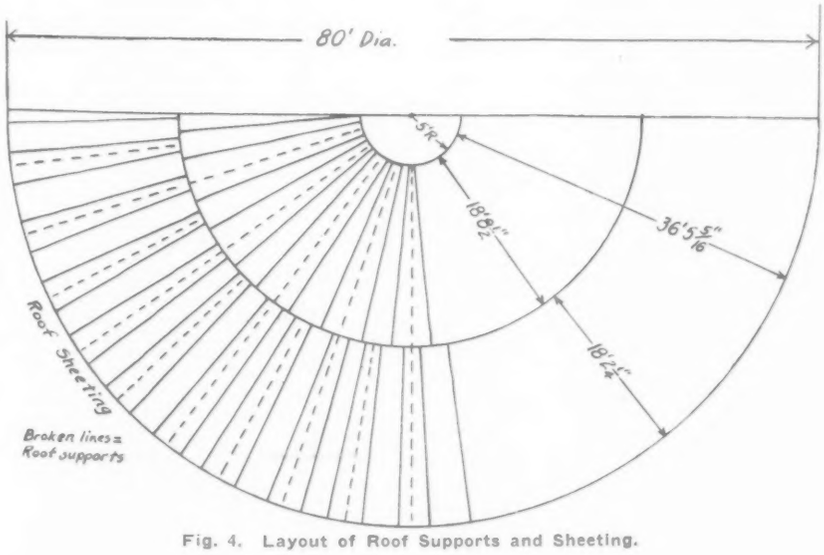


Fig. 4. Layout of Roof Supports and Sheeting.

Compiles List of States and Cities Adopting A.S.M.E. Boiler Code

Data Sheet No. 4, issued by The American Uniform Boiler-Law Society, 253 Broadway, New York, N. Y., gives a list of states and cities that have adopted or accepted the 1931 Edition of the A. S. M. E. Boiler Construction Code. This report is compiled according to code sections.

Cleveland A.W.S. Discusses Technocracy and Metal Spraying

At the meeting of the Cleveland Section, American Welding Society, held on the evening of January 11th in Engineers Hall, 410 Hanna Bldg., the program was divided into four 15-minute talks, each followed by a discussion. About 75 were in attendance.

A. F. Davis, vice-president, Lincoln Electric Company, and regional director of the A.W.S., gave a talk on "What a Membership in the A.W.S. Means." This was followed by "Technocracy-Welding" by R. K. Randall, president, Cleveland School of Welding, Inc. W. T. Alleman, graduate of Zurich (Switzerland) University, discussed "Welding in Europe"; and E. R. Benedict, president, United District Heating Company, told about the "Use of the Metal Spray in the Welding Industry."

New Equipment

Arc Welding Now Goes Everywhere

Out-of-doors welding has been given a novel tool in the all-weather crawler-tractor-mounted arc welder recently announced by the Universal Power Corporation, Cleveland, Ohio. The welder, driven by the tractor engine, utilizes the shunt-inductor principle of arc stabilization regularly built into all the

Arc Welder on Crawler-Type Tractor.

company's portable road trailer V-8-engined welders and motor-generator welders.

This equipment consists of a standard Universal welder carefully tailored to the Cletrac crawler tractor to provide a mobile weld tool of utmost overall economy which is easily moved close to the job despite handicaps of a rough and rugged country.

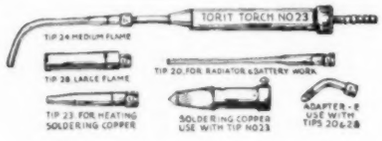
For railroad maintenance-of-way welding and bridge maintenance, the unit may be operated either on shoulders, rails, or ties, and may easily be moved on or off the track under its own power. It is also adaptable for pipe-line welding or structural steel erection. The welder mounting, it is claimed, does not in any way restrain fullest use of the tractor for drawbar work. The whole welder assembly may be easily demounted by removal of a few bolts.

New Brazing Process for Cemented Carbide Tools

For attaching cemented carbide tips of various kinds to steel shanks, the Z-Foil process has been developed and patented by Thomas Prosser & Son, 15 Gold St., New York, N. Y. Dovetailing of the tip is eliminated, and the bond is said to be stronger than that produced by the usual method of copper brazing in the muffle or hydrogen furnace. It is also claimed that the Z-Foil bond absorbs stresses caused by the difference in coefficient of expansion between the tip and the steel shank, and that the process is applicable to extra-hard and extra-tough shanks. The new bonding material is said to have a cushioning effect which helps to absorb service shocks, and the tip remains cooler than ordinarily since the heat is rapidly dissipated into the shank. This process is not intended for brazing together large surfaces, but was developed specifically for brazing "Widia" hard-metal composition tips to steel shanks.

New Air-Acetylene Torch for Soldering and Light Brazing

A small torch with four different tips, a soldering copper, rubber tubing, and connection for the small Presto acetylene tank, constitutes what is known as the "Torit" Soldering Outfit No. 23. It is said to be very handy and convenient for soldering, tempering, light brazing, wire splicing, etc., and for all sorts of small jobs requiring heat. It is not intended for welding. Connected to the Presto tank, it is ready to go to work with the lighting of a match. No oxygen or compressed air is required. The necessary air for


TORIT TORCH NO 23
TIP 24 MEDIUM FLAME
TIP 28 LARGE FLAME
TIP 20 FOR RADIATOR & BATTERY WORK
TIP 23 FOR HEATING SOLDERING COPPER
SOLDERING COPPER USE WITH TIP NO 23
ADAPTER - E USE WITH TIPS 20 & 28

Torit No. 23 Soldering Outfit.

combustion is syphoned through the tips. Full information can be obtained from the manufacturers, the St. Paul Welding & Mfg. Co., 214 West 3rd St., St. Paul, Minn.

Hobart Announces Low-Priced Arc Welder

A low-priced arc welder, electric drive, rated at 125 amp., has been announced by Hobart Brothers, Box U 122, Troy, Ohio, who is offering it to shops on 30 days' trial. This welder is provided with remote control and the dual feature of handling both plain rods and coated shielded-arc rods. The arc is said to be steady and easily controlled, and the manufacturer states that the welder meets U. S. Navy specifications in efficiency, speed, and constancy of arc. A folder is available describing this new machine and telling how it can be put into one's shop on trial.

Redesign of Oxweld Cutting Attachment

An improvement in the Oxweld Type CW-17 cutting attachment has been announced by The Linde Air Products Company, New York, N. Y., whereby the heating oxygen throttle can also be used as an oxygen shut-off valve for use during temporary stops in cutting. The throttle has been redesigned and the valve packing improved to make the valve operate more easily. The general redesign makes a more convenient attachment.

Blackote Electrodes Added to Swedox Line

A new electrode, designated as Blackote, has been developed by the Central Steel & Wire Co., 4545 S. Western Blvd., Chicago, Ill., for the welding of tanks, plates, structurals and ornamental iron, and for most mild-steel applications.

The Blackote electrode is said to produce a very highly stabilized saturated-core-type arc, which makes it very easy to operate, and increases production and quality of work. The electrode gives off no odor when operating, due to its all-mineral coating; and no ill results are obtained, due to its complete lack of carbon in any form in the coating.

Practical tests of welds made with Blackote show strengths running well above 55,000 lb. per sq. in., freedom from porosity, and very good ductility. The operator will also find, it is claimed, that welding is easily accomplished in any position, overhead and vertical welding being as simple and easy as flat welding.

Another interesting feature of this new electrode is its adaptability to weld where the work is heavily coated with paint, rust, red lead, grease, etc., or for the welding of galvanized surfaces.

Wilson Brings Out New Machine for High-Capacity Welding

A new 4-bearing, self-excited, dual-control, arc welder known as Model S.A. is now in production at the plant

New Wilson Welder.

of the Wilson Welder & Metals Company, Inc., North Bergen, N. J. This machine is built to meet the ever-increasing demand for the high amperages and arc voltage required in speed and shielded-arc welding. It offers the advantage of a two-unit machine with flexible coupling, which permits the changing of either the motor or generator. Particular care is taken to cover all terminals and other live parts, and to eliminate projecting parts as far as possible. The design is said virtually to eliminate the possibility of

accidental breakage of the control handles or meters. The machine is thoroughly accessible, the parts being exposed for adjustment or removal by loosening the wing nuts and lifting the side covers. The voltage or amperage may be set independently of the other. The machine is said to weld easily at rated current with 40 volts across the arc. It is built to NEMA and U. S. Navy specifications.

New Extensometer for Determining Yield Point

The Oxweld Extensometer Type TM-3 has been developed by The Linde Air Products Company, New York, N. Y. A pamphlet describing this new instrument explains how it is to be used to determine the yield point of a specimen or its elongation under specified loads. This extensometer is said to be so sensitive that it will indicate the elongation occasioned in a standard A. S. T. M. test specimen by the heat of the human hand. It is very simple and rugged in design, and its maintenance is said to require, with ordinary care, only the occasional replacement of the small electric battery and bulb, which may be obtained at most any electrical store.

New Photographic Plate Suitable for Metallography

A photographic plate designed especially for photomicrography of metal specimens has been announced by the Eastman Kodak Company, Rochester, N. Y. In addition to having properties which render it particularly suitable for metallography, it should also appeal to those photomicrographers who prefer not to use panchromatic plates which require handling in the dark, since this new plate is not sensitive to the red light of the dark room. The new plate is said to have a high resolving power, to produce high photographic contrasts, and to be highly sensitive to green and blue light without sacrifice of the emulsion's resolving power.

New Welding Torch Added to Purox Line

Purox No. 28 welding torch is the latest addition to the line of Purox torches manufactured by The Linde Air Products Company, New York, N. Y. This torch is said to be adaptable to a wide range of work and to be highly economical in gas consumption. Ten one-piece 60° goose-neck tips, numbered from 6 to 15, are available for use with this torch. By means of a union nut these tips may be adjusted to point in any direction, so the normal grip of the torch handle may be used for any position of welding. Five tips supplied with the torch give it a range from 16-gage sheet up to heavy castings. A similar torch, No. 28B, is supplied with tips Nos. 6 to 10 only.

By means of an adapter, the tips for the No. 11 welding torch can be used on both the No. 28 and No. 28B torches, thus providing a convenient and economical means of increasing the range of usefulness of the No. 28 torch in the lighter welding field, and obviating investment in an additional small torch when there is only occasional need for light welding.

[Trade Literature]

The welding of manganese steel by the Murex method is described in a bulletin issued by the Metal & Thermit Corporation, 120 Broadway, New York, N. Y., in which details are given of the application of this method to fractured manganese steel castings and for building up battered and worn manganese steel parts and wearing surfaces.

"The Welding of Genuine Wrought Iron" is the title of a folder published by the A. M. Byers Company, Pittsburgh, Pa., which explains both the gas and electric-arc processes of welding. The chemical analysis of Byers genuine wrought iron is given, together with the outstanding characteristics of the metal.

"Elements of Design—Clevises and Pins" is the subject of Application Sheet No. 32 of Series 2, issued by The Lincoln Electric Company, Cleveland, Ohio. Drawings show various designs of welded clevises and pins that will be useful to the machine designer.

A new Torchweld price list, No. 32, has been issued by the Torchweld Equipment Company, 224 N. Carpenter St., Chicago, Ill. Prices are listed on various kinds of welding rods and wire, brazing rods, fluxes, solder, goggles, gas hose, hose connections, and flame lighters.

A leaflet describing electrodes and filler rods for metallic and carbon arc welding of aluminum, gas and arc welding fluxes for aluminum welding, aluminum soldering flux, aluminum stick solder, aluminum wiping solder, and aluminum thread lubricant, has been issued by Wooldridge & Larson, 195 Naubuc Ave., Glastonbury, Conn.

The Oxweld portable tensile testing machine is described in a pamphlet issued by The Linde Air Products Company, New York, N. Y. Details of construction and complete directions for operating are given, as well as explanations of the proper methods of preparing coupons for testing and of calculating the tensile strength. By means of a nomographic chart, calculations of the ultimate tensile strength are simplified.

"Stainless Steels and Their Uses" is the title of a 20-page booklet issued by the Electro Metallurgical Company, 30 East 42nd St., New York, N. Y., in which several hundred uses of chromium-alloy stainless steels are listed. Many interesting applications are shown in pictures.

Various types of welded tanks and other containers constructed of Lukens nickel-clad steel are shown in a two-page spread in a recent issue of Inco, published by The International Nickel Company, Inc., 67 Wall St., New York, N. Y.

The use of transparent test models in designing a welded press frame is told in a reprint entitled "Arc Welding Introduces New Methods in Machine Design," issued by Lukenweld, Inc., Coatesville, Pa.

[News *of the* Industry]

F. J. Giroux Joins Universal Power Corporation

F. J. Giroux, of New York, widely known for his welding engineering and consulting work, has become associated with Universal Power Corporation, of Cleveland, Ohio, as representative in charge of the sale of Universal arc welders in the New York district.

After graduation from Oregon State College, Mr. Giroux became associated with the Westinghouse Electric & Manufacturing Company, and later with Arcos Incorporated. He spent three months in Europe studying welding methods and obtaining special training in the process of manufacturing coated electrodes. Upon returning to the United States, he engaged in demonstrating the use of coated electrodes and worked as a general welding consultant. He recently completed a reorganization of the welding department of the Roessler & Hasslacher Chemical Company.

C. J. Holslag Reveals Secret of Z-Ray

The Z-ray, about which a great deal of mystery has lain, has at last had its secret divulged. C. J. Holslag, of the Electric Arc Cutting & Welding Company, supplied Santa Claus this year with several packfulls of Z-rays to be distributed among his friends. This optical instrument makes a tiny flaw in a weld look like the Grand Canyon of the Colorado, and a pinhole under the Z-ray can be stepped into if you don't watch out. The magnifying glass—though ages old—has never lost its interest to both young and old. The

welder has at last found that the microscope is the mysterious Z-ray; and with more Z-rays in use for examining welds, it is assured that there will be more and better welding done.

Reduction in Prices of Murex Electrodes

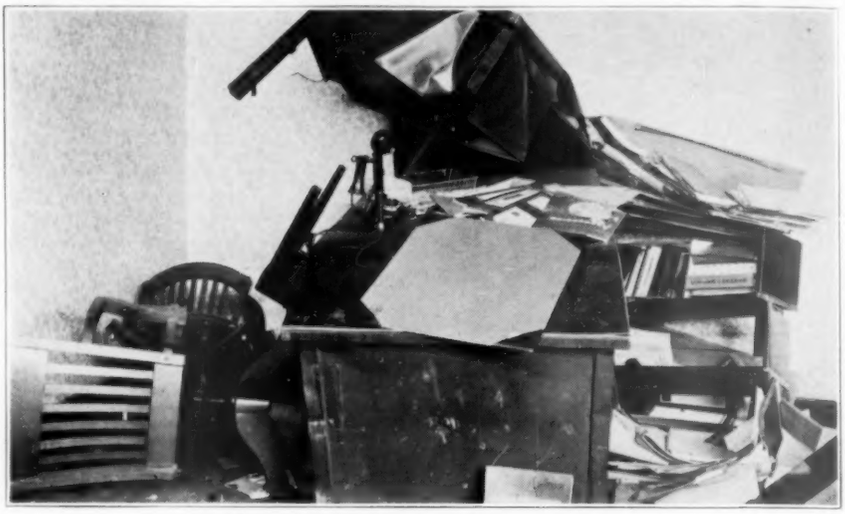
Metal & Thermit Corporation, 120 Broadway, New York, N. Y., announces a substantial reduction in prices of the most commonly used sizes of Murex electrodes. Wide acceptance of these all-mineral-coated electrodes in the metal-working industries and consequent greatly increased production and lower unit costs, according to the manufacturers, make possible the announced reduction.

Eliminates Spoilage in Welding of Housings

In the welding of rear housings, the Chrysler Corporation are using six or eight men on one line with no spoilage reported, reports Thomas Marshall of the Marshall Electric Company, Elkhart, Ind. This record is made possible by the use of a Marshall Electric carbon-pile regulator which automatically holds the welding voltage constant irrespective of violent changes in load.

Parker B. Francis Heads Puritan Gas Corporation

The directors of the Puritan Gas Corporation, Kansas City, Mo., have unanimously elected Parker B. Francis as president to succeed John R. Foran, whose death was reported in the December issue of *The Welding Engineer*. Mr. Francis was associated with Mr. Foran in the development of the company from its start in 1915, and, under the terms of a personal agreement, he has taken over Mr. Foran's holdings in the company. Prior to his association with Mr. Foran, Mr. Francis was with the original Oxygen Gas Company. He is a member of and active in many technical and civic organizations.



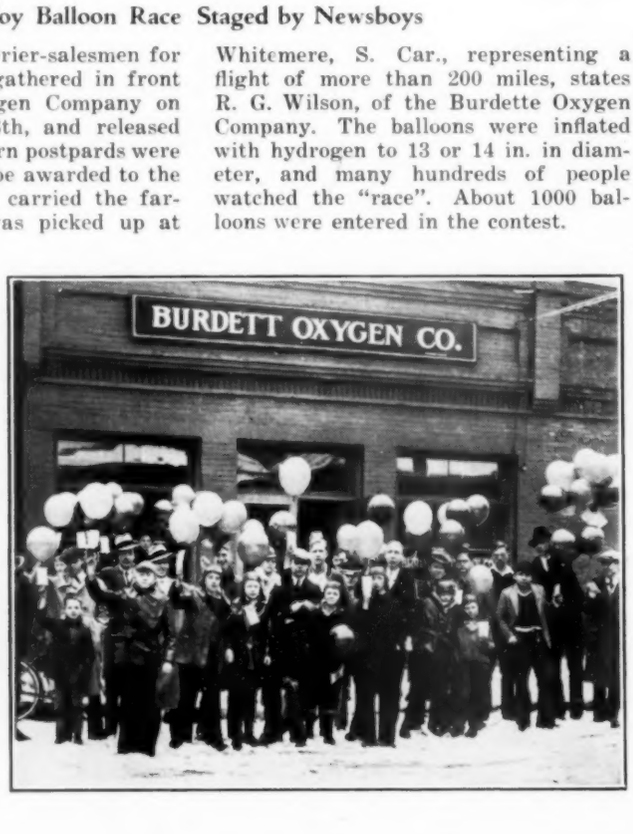
View in Office of Hill Equipment Engineering Co. After a Car Entered Through the Window.

A Chevrolet Makes an Office Call

A driver in a brand new Chevrolet, while trying to pass another car, lost control and the car careered through the plate glass window of the Hill Equipment Engineering Company, who sell "Lincoln" welding equipment in the St. Louis territory. About $350 damage was caused to desks, filing cabinets and office furniture, and file copies of *The Welding Engineer* were scattered all over the floor. The steel desks shown above belong to the president of the concern, Lockwood Hill, and Basil N. Osmin, salesman. This happened on December 13th, when the occupants of the office, fortunately, were making calls on the outside. "Who says '13' is an unlucky number?" asks Mr. Osmin, who adds, "This accident may have another moral in that it pays to go after the business in more ways than one."

Toy Balloon Race Staged by Newsboys

Several hundred carrier-salesmen for the *Atlanta Journal* gathered in front of the Burdette Oxygen Company on Sunday, December 18th, and released balloons to which return postpards were attached. Prizes will be awarded to the carrier whose balloon carried the farthest. One balloon was picked up at Whitemere, S. Car., representing a flight of more than 200 miles, states R. G. Wilson, of the Burdette Oxygen Company. The balloons were inflated with hydrogen to 13 or 14 in. in diameter, and many hundreds of people watched the "race". About 1000 balloons were entered in the contest.



Newspaper Carrier-Salesmen Ready to Hold a Balloon Race. The Balloons Were Filled With Hydrogen Gas, and One Traveled More Than 200 Miles.

News in Brief

J. Lester Perry, manager of the Worcester, Mass., district of the American Steel & Wire Company, has been elected a vice-president of the company in charge of operations, succeeding Charles F. Blackmer, who becomes president in succession to John S. Keefe.

One of the most proficient and capable welders in the city of Elkhart, Ind., is a girl—Miss Lois Warren, 311 Hillside Court—who is doing spot and acetylene welding for one of the largest concerns in Elkhart, and is considered equal in ability to any of her fellow welders. She has been welding for three years, and received her training through a factory apparatus representative. She is thoroughly conversant with neutral flames, preparation of material, heats, etc., and frequently does repair jobs for members of the concern for which she works.

Roy Thomas, of the Torch Shop and Factory, 1637 E. Vernon Ave., Los Angeles, Calif., has prepared a mimeographed pamphlet entitled "Care and Upkeep of Your Welding Equipment" for distribution among his customers. This pamphlet deals principally with

regulators and oxyacetylene torches and contains a lot of good, sensible advice.

Robbins & Kaatz, welders and expert boilermakers, of Los Angeles, Calif., have joined in an arrangement with the Industrial Inventions Manufacturing Company at 6355 Compton Ave., whereby they will handle job welding of all kinds at that location.

Under the name of Harry Buegeleisen, at 287 Fulton St., Brooklyn, N. Y., a new goggle and sunglass organization has been formed, with the cooperation of former executives of Strauss & Buegeleisen. A specialty of the new firm will be welding goggles. The work of the older firm will be carried on in the manufacture and design of goggles, etc., with a fully reequipped staff and facilities.

John C. Dewey, Huntington Park, Calif., who owns and manages a welding shop in that city, recently opened a second shop at 237 South Figueroa Blvd. in Los Angeles. Mr. Dewey features general automotive welding jobs with special attention to car-starter-teeth welding and repairing of cracked motor blocks. Mr. Dewey's shops are operated under the name of the Dewey Welding Works.

"Tex." Hurd, Long Beach, Calif., who until recently operated an oil-field service welding shop at 232 Colombia Ave., has moved his equipment to 3095 Cherry Ave., formerly occupied by the Associated Welding Works. This location is in the Signal Hill oil field, and is the same location which Mr. Hurd occupied when he first entered the welding field several years ago. Mr. Hurd was among the first welders to operate in the Signal Hill oil field and saw the first well brought in in that area. He will continue to feature oil-field welding of all kinds, specializing in the servicing of oil-well digging bits and other hard-facing work.

A new welding shop recently opened for business at 10703 Alameda Blvd., Los Angeles, Calif. The new shop will be operated by E. H. Sammons and his son, R. D. Sammons, who will engage in welding of all kinds in addition to blacksmithing and machine work. This location until recently was occupied by W. O. Burroughs, of the Burco Engineering Company, which featured welding also for the most part.

Bert T. Oxley, Bell, Calif., who until recently was in charge of welding for the American Laundry Machine Company in Los Angeles, has opened a job welding shop at 8337 Atlantic Blvd. The new shop will be known as the Oxley Welding Works.

Jack's Welding Shop, formerly located at 1317 E. Florence Ave., in Los Angeles, Calif., has been moved a short distance to a new location at Florence and Hooper St. J. A. Stoddard, who owns and operates the shop, features general job welding of all kinds.

Thomas A. Fabrin & Sons, Pasadena, Calif., recently moved their welding shop and ornamental-iron works into the adjoining building from their old location at 25 Valley St. Their slogan for the welding department is "If we can't weld it, throw it away."

L. J. Peters, of the Peters Welding Works, San Diego, Calif., is moving his equipment from the old location at 14th

"T'ell with the Depression"

The Atlas Boiler & Welding Company, Elgin, Ill., (Vale and Kuhlman, owners) have a contract for the cutting down of the bridge over the Fox River at Algonquin. This bridge is 202 ft. long and 20 ft. wide and has four spans. A new bridge of steel and concrete will be completed by spring.

A new industry for Phoenix, Ariz., which will employ a great amount of welding in different forms, will soon be in operation upon the completion of a new $65,000 plant of the Consolidated Steel Pipe & Tank Company. Franklin Hageman, for twenty years with the United States Steel Corporation, is president, and Alfred Johnson, who for the past four years has been manager of the Arizona Steel Pipe & Tank Company of Phoenix, is vice-president and general manager.

The Valparaiso Welding Shop, Valparaiso, Ind., of which E. W. Knapp is proprietor, has just completed a contract covering the reinforcing of a considerable amount of road-grading equipment for the highway department. This equipment was not rigid enough to stand the test, so the manufacturer supplied the reinforcing materials and Mr. Knapp arc welded them into place.

A. H. Friese, president of the Welding Engineering Company, Milwaukee, Wis., reports the sale of Hansen welders to the General Welding Company, Milwaukee; Fuller-Warren Company, Milwaukee; and James Manufacturing Company, Ft. Atkinson, Wis.

The W. A. Lounsbery Company, Kalamazoo, Mich., have been constructing quite a large number of brine tanks for customers in their section. A recent one for the Arctic Ice Cream Company, of Kalamazoo, was 4x5x12 ft. in dimensions and completely arc welded.

The Grand Rapids Welding Supply Company, Grand Rapids, Mich., are remodeling their main store location at 540 Division St. at a cost of approximately $5000. The building is being given a new brick front, and the lower floor will have window displays and an attractive 22x20-ft. display room, with an open stairway leading to the offices on the second floor. The displays will include Red Cap oxygen and acetylene and the Philgas line of equipment.

The American Welding Company, of Milwaukee, Wis., recently purchased a Wilson Welder.

The Lincoln Highway Garage, Valparaiso, Ind., recently installed a new G-E arc welder, which is in addition to their present gas-welding equipment. Mr. Cole is manager and John Kuss is the welding operator.

The welding on a two-span reinforced steel bridge over the St. Joe River at Buchanan, Mich., was recently completed by the Elkhart Welding Company, 220 Elkhart Ave., Elkhart, Ind. G. H. Riblet, proprietor of this shop, has added a 400-amp. Lincoln Stable-Arc welder to his equipment.

The Wilshire Oil Company, one of California's largest independent oil refiners, is reported to be completing plans for an important welding job in the installation of extensive welded pressure vessels and other cracking equipment for its refinery at Vernon.

The Schwab Machine & Welding Works, Ventura, Calif., report the recent purchase of a new 600-amp. Westinghouse welding unit. This concern is located on Ventura Boulevard and recently completed the construction of an addition to their shop for a welding department, the framework being of welded pipe.

The Schlueter Boiler Works, Janesville, Wis., of which Al Schlueter is proprietor, has completed a contract for the Blumer Products Company, of Monroe, Wis., covering the construction of six 30x8x5-ft. all-welded tanks with compartments, the erection of an all-welded water tank on the roof of the factory, and the welding of all the structural members for the new factory addition.

The Skeline brothers, Art and Marshall, who operate a job welding shop at Cassopolis, Mich., recently added a 15-in. LeBland lathe complete with all attachments, a Cincinnati milling machine, a pair of Dockson regulators, and a Purox cutting torch. They are planning to add other equipment from time to time until they will have the most complete job welding and machine shop in their section.

and "F" Sts. to 1352 North State St. The new location is in the same building as the Superior Machine Shop. Mr. Peters was formerly associated with M. L. Beck, whose interests Mr. Peters has acquired in the new arrangement. The shop, as usual, will be equipped for handling both field and shop work.

Guy Danielson, formerly with the Brauer Machine & Supply Co., Oklahoma City, Okla., is now associated with the Chicago Pneumatic Tool Company as representative for the oil-tool division in Oklahoma City. The Brauer Machine Company employ welding extensively in their plant at Oklahoma City.

Turner C. Smith, chairman of the Los Angeles section of the American Welding Society, has been confined at his home in Los Angeles with an attack of the influenza. Mr. Smith is connected with the engineering department of the General Petroleum Corporation, with offices in Vernon.

Memo pads, with a calender on the back, advertising "Safe-Weld" products, are being distributed by the Welding Engineering Company, Milwaukee, Wis., to their customers and friends.

The welder purchased by the Theo. Kupfer Foundry & Machine Company, Madison, Wis., reported in the December issue of *The Welding Engineer*, was a Wilson machine and was sold by the Air Reduction Sales Company, 818 W. Winnebago St., Milwaukee, Wis.

The Welding Engineering Company, 1432 W. Lake St., Chicago, of which A. H. Friese is president, have been appointed distributors for the Hansen arc welder, manufactured by the Harnischfeger Corporation, Milwaukee, Wis.

Ralph Kelly, formerly southwestern district manager of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been appointed central district manager of the company with headquarters in the Gulf Building, Pittsburgh, Pa.

The Welder Exchange Company, 2107 W. Vliet St., Milwaukee, Wis., has been organized for the purpose of carrying on a business in the exchanging, trading in, reconditioning, and selling of arc welders of all sizes and makes.

N. Peterson, 14 Front St., Niles, Mich., has worked up a considerable amount of local business in a cast-iron flux, a hard solder, and a tinning compound which he developed and originally produced for his own consumption.

Geo. Uhlir, proprietor of Uhlir Welding Shop, 622 Cross St., Janesville, Wis., recently added a small microscope to his shop equipment for studying welds and fractures. The instrument has a magnifying capacity of 250 diameters.

Recent cold weather caused the seams to open and the rivets to loosen in a 50,000-gallon water tower located 100 ft. in the air at the Healthwin hospital, South Bend, Ind. The Bach Welding & Boiler Works effected repairs by welding the rivets and seams from the inside. Approximately 250 ft. of welding was done with a Lincoln 300-amp. welder and G-E high-speed rod.

The McSwain-Erickson Welding Co., 203 Morgan St., Rockford, Ill., of which D. Erickson is proprietor, recently completed the welding of a 10-ton steam-hammer base which was badly broken. In addition, two 250-lb. blocks of steel were welded into the base at the point where the sow blocks fit, which gave additional bearing surface for the columns. Arc welding with Hollup rod was used without any studding.

The Blackhawk Welding Company, 410-412 Kishwaukee St., Rockford, Ill., has been formed with R. W. Youngberg and Carl Erickson as proprietors. The shop has been equipped with gas welding equipment and with a portable arc welder.

The West Coast Pipe & Steel Company, Los Angeles, Calif., were recently awarded the contract for furnishing 5,300 ft. of welded 20-in. steel pipe for a water line to be used for irrigation purposes near Terra Bella, Calif. Fabrication of the pipe will be by both acetylene and electric welding processes, the long seams being by automatic electric and the round seams by acetylene.

The Schwab Machine & Welding Works, Ventura, Calif., recently built an addition to their plant near Ventura Blvd. The additional space will be used by the welding department, and a corner will be given over to office space. The framework of this additional room was of all-welded construction, being made of 3-in. oil-well drill pipe and 8-in. channel iron.

The Puget Sound Power & Light Company, Puyallup, Wash., has equipped a shop for general maintenance of its equipment, which will include an up-to-date welding department. The shop, which was recently leased by the company, is situated at Stewart St. and Second Ave.

Earl Tupes, who for many years has been connected with the welding industry, has opened a job welding shop at 1853 Peck St., Muskegon, Mich., where he will handle a complete line of oxyacetylene welding and cutting equipment and supplies as well as maintain a repair station for all makes of oxyacetylene apparatus. Mr. Tupes was recently appointed by the Grand Rapids Welding Supply Company as distributor of Red Cap oxygen and acetylene in the Muskegon district.

The annual series of lectures to the engineering classes of Purdue University, Lafayette, Ind., which precede the annual welding conference, were conducted this year by E. H. Bergstrom and E. P. W. Smith, of the Lincoln Electric Company, the subject being "Methods of Determining Bad Welds and Procedure."

W. H. Joor, who operates a welding shop at 4380 E. 9th Street, Los Angeles, Calif., recently moved to this location from his old stand at 4416 E. Telegraph Road. Mr. Joor, in addition to general job welding of all kinds, specializes in the welding of car starter teeth.

Five worm-gear screw type truck-loading lifts for the new Chicago postoffice were recently completed by the Leitelt Iron Works, of Grand Rapids, Mich., says F. H. Meyer, vice-president and general manager. All the framework, platforms, and curbing were welded with "Fleetweld" electrodes in their shop.

C. P. Olson, of El Monte, Calif., recently acquired the welding and machine shop equipment at 612 East Valley Blvd., and has opened the plant under the name of the C. P. Olson Welding & Manufacturing Company. In addition to machine work and general repair welding of all kinds, Mr. Olson will manufacture a new type of heating pot for use in the Southern California citrus groves. This product, which will be known as the Hodge Orchard Heater, is all-welded, and is designed along improved lines for eliminating the objectionable smoke which has always accompanied the ordinary types of smudge pots.

Welding is employed extensively in the manufacture of a new line of large water heating units recently placed on the market in Los Angeles by the Yellowstone Water Heater Corp., located at 1010 W. 84th Place. Electric welding is employed principally in the building of these heaters.

N. W. Snider, formerly welder for the Peabody Seating Company, North Manchester, Ind., has opened a job welding shop under his own name in the same city. Mr. Snider has just purchased a 200-ampere Lincoln arc welder and Smith gas welding equipment.

The Acme Welding Company, 607 Ottawa Ave., Grand Rapids, Mich., have constructed a very novel and efficient machine cutting outfit. Though at present hand operated, later it will be made fully automatic by adding a motor drive. The entire unit, including cutting torch, was built in their shop.

The Pacific Electric Railway, Los Angeles, Calif., recently welded 3,800 ft. of butt-welded track near Culver City. Most of this welding was done by oxyacetylene, employing H. C. Oxweld No. 6 welding rod. The electric process of welding is also being experimented with in this work with no failures being found thus far. By welding these joints, practically all track upkeep expense is eliminated.

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1 Alternare Universal, 110/220/440 AC & DC (Real Bargain)	400.00
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1 Dualarc, 200-amp., 1200-RPM	375.00
1 Dualarc, 200-amp., with 110 volts	400.00
1 Lincoln, 300-400-amp., with base	475.00
1 G.E., 300-400-amp. (New Machine) still in crate	475.00

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1 200-amp. NEMA, Westinghouse M.G., 220/440, 3-phase	400.00
1 USL with shaft extension, 220/440, 3-phase, 60-cycle	400.00
2 200-amp. Lincolns, 220 volts DC, on trucks. Each	375.00
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1 Wilson 200-amp.	300.00

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